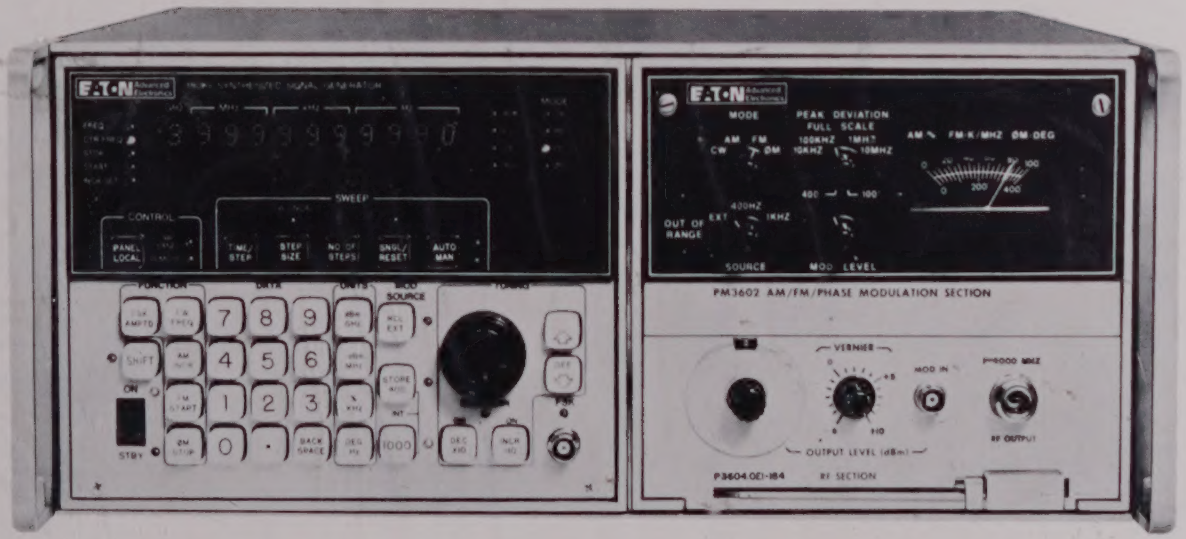
OPERATION AND MAINTENANCE MANUAL

AILTECH

380 SYNTHESIZED SIGNAL GENERATOR

380K11 MAINFRAME



EATON Advanced Electronics

Eaton Corporation
Electronic Instrumentation Division
Ronkonkoma, New York 11779

Eaton Corporation
Electronic Instrumentation Division
2070 Fifth Avenue
Ronkonkoma, N.Y. 11779
(516) 588-3600
Telex 510-288-6507

AILTECH

380 SYNTHESIZED SIGNAL GENERATOR **MANUAL REGISTRATION**

DATE: ____________

In order to assist in the maintenance of your manual with revision sheets when they become necessary, please complete the following information and drop this card in nearest mailbox.

MODEL NO. ____________________ SERIAL NO. ____________

Name: ______________________________ Title: ____________

Company: ______________________________ Mail Zone or Dept: ____________

Street: ______________ City __________ State __________ Zip __________

Telephone: ( ) ______________________ Extension ______________

EATON Advanced Electronics

Eaton Corporation
Electronic Instrumentation Division
2070 Fifth Avenue
Ronkonkoma, N.Y. 11779
(516) 588-3600
Telex 510-288-6507

Date: ____________

Please send me additional information on the following AILTECH products:

- ☐ Spectrum Analyzers
- ☐ Synthesized Signal Generators
- ☐ Noise Measuring Equipment
- ☐ Broadband Power Amplifiers
- ☐ EMI Instrumentation
- ☐ AC Instrumentaton
- ☐ Communications Service Monitors
- ☐ Broadband Sweep Oscillators
- ☐ High Power Signal Sources

I would like applications assistance on: ______________________________

Call me to schedule a demo on: ______________________________

☐ I need price and delivery information.

My requirement is: ☐ Current ☐ Proposal ☐ Budgetary ☐ File

Name: ______________________________ Title: ____________

Company: ______________________________ Mail Zone or Dept: ____________

Street: ______________ City __________ State __________ Zip __________

Telephone: ( ) ______________________ Extension ______________

EATON Advanced Electronics

FIRST CLASS
PERMIT NO. 1157
RONKONKOMA, N.Y.
11779

BUSINESS REPLY MAIL

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by

Eaton Corporation
Electronic Instrumentation Division
2070 Fifth Avenue
Ronkonkoma, New York 11779

Publications Department

FIRST CLASS
PERMIT NO. 1157
RONKONKOMA, N.Y.
11779

BUSINESS REPLY MAIL

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by

Eaton Corporation
Electronic Instrumentation Division
2070 Fifth Avenue
Ronkonkoma, New York 11779

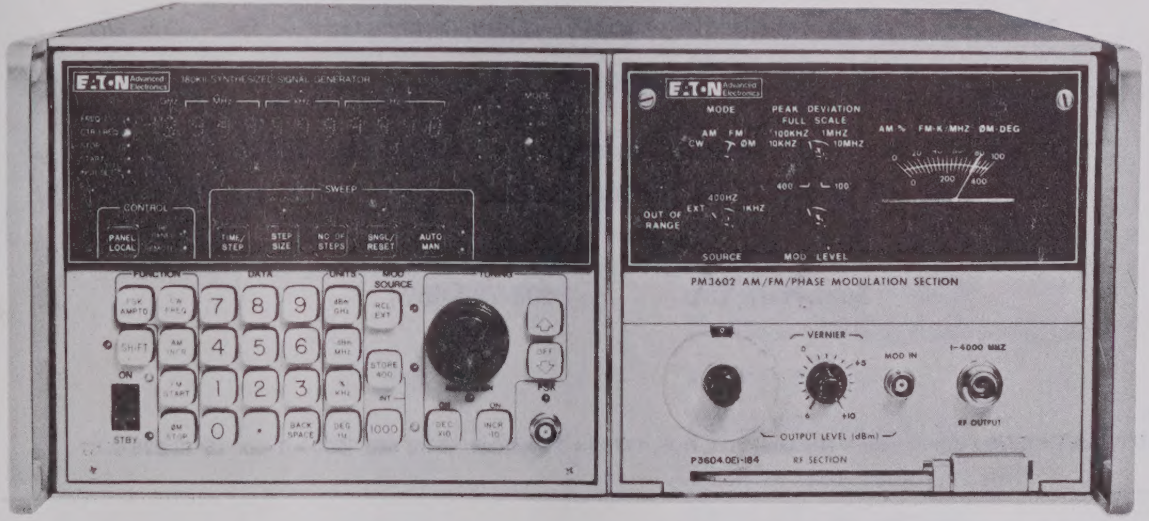
Sales Department

OPERATION AND MAINTENANCE MANUAL

AILTECH

380 SYNTHESIZED SIGNAL GENERATOR

380K11 MAINFRAME



SEPTEMBER 1980
REVISED APRIL 1981
REVISED MARCH 1983

EATON Advanced Electronics

Eaton Corporation
Electronic Instrumentation Division
Ronkonkoma, New York 11779

WARRANTY

This instrument is protected by a full one year warranty against defects in workmanship and materials, except for fuses which carry no warranty. Eaton Corporation, Electronic Instrumentation Division in connection with equipment sold, agrees to correct any defect in workmanship or material which may develop during the period of one year from the date of shipment under proper or normal use and not in excess of the original manufacturer's life expectancy ratings, by its option to repair or replace, FOB point of shipment, the defective part or parts. Such correction shall constitute a fulfillment of all Eaton Corporation, Electronic Instrumentation Division liabilities in respect to said instrument.

SERVICE

Additional service information can be made available by calling Eaton Corporation, Electronic Instrumentation Division.

Ronkonkoma, N.Y.	516-588-3600
Sunnyvale, CA	403-733-6574

PRODUCT OF
LONG ISLAND PLANT • 2070 Fifth Avenue • Ronkonkoma, N.Y. 11779 • Telephone: (516) 588-3600 • Telex: (510) 228-6507

LOS ANGELES PLANT • 5340 Alla Road • Los Angeles, Ca. 90066 • Telephone: (213) 822-3061 • Telex: (910) 343-6969
FRANCE • Sartrouville • Telephone: 915-2627 • Telex: 697591
UNITED KINGDOM • Crowthorne • Telephone: Crowthorne 5777 (Area 3446) • Telex: 847238
GERMANY • Munich • Telephone: (089) 5233023-24 • Telex: 529420
HOLLAND • Rozenburg N-H • Telephone: (02977) 29376 • Telex: 18399

Handbook — Part No. 296593 — MANUAL

FOREWORD

The 380 Series Synthesized Signal Generator Manual comprises a complete handbook when used in conjunction with the proper plug-in and modulation manuals.

The 380K11 Mainframe and 3600E1 Frequency Extender Manual contains general information relating to the operational characteristics of the instrument and information required to service and maintain the instrument. Included are schematics, troubleshooting procedures, system calibration instructions and a replaceable parts list.

The following manuals are required for a complete set.

Model	Manuals
380	380K11 Mainframe P360180E1 RF Section
380M	380K11 Mainframe P360180E1 RF Section PM3602 AM/FM/Phase Modulator
381	380K11 Mainframe P3601.8E1 RF Section
381M	380K11 Mainframe P3601.8E1 RF Section PM3602 AM/FM/Phase Modulator
382	380K11 Mainframe P3602.0E1 RF Section
382M	380K11 Mainframe P3602.0E1 RF Section PM3602 AM/FM/Phase Modulator
384	380K11 Mainframe P3604.0E1 RF Section
384M	380K11 Mainframe P3604.0E1 RF Section PM3602 AM/FM/Phase Modulator

TABLE OF CONTENTS

Paragraph Title Page

CHAPTER 1 — GENERAL INFORMATION

1-1 Introduction 1-1
1-4 Description 1-1
1-5 Mainframe 1-1
1-8 Frequency Extender 1-3
1-9 Options 1-3
1-10 Accessories 1-3
1-11 Test Equipment 1-16
1-12 Mainframe Subassemblies 1-16
1-13 Frequency Extender Subassemblies 1-16

CHAPTER 2 — INSTALLATION

2-1 Introduction 2-1
2-3 Unpacking 2-1
2-5 Preparation for Use 2-1
2-7 Frequency Extender Installation 2-1
2-8 Frequency Standard Installation 2-3
2-9 RF Section Installation/Removal 2-3
2-11 Modulation Section Installation 2-4
2-13 Rack Mounting 2-4
2-16 Initial Turn-On 2-5
2-18 Initial Checkout 2-5

CHAPTER 3 — OPERATION

3-1 Introduction 3-1
3-3 Controls, Indicators and Connectors 3-1
3-5 Reference Oscillator Stabilization 3-1
3-8 Operators Maintenance 3-1
3-10 Detailed Operating Instructions 3-10
3-11 Controlled Functions 3-10
3-12 Shift Key 3-10
3-13 Initialize 3-10
3-14 Frequency, Modulation and Level 3-11
3-15 Tuning/Incrementing 3-11
3-16 Frequency Incrementing Within Decades 3-12
3-17 Frequency Set Incrementing 3-12
3-18 Amplitude Incrementing in Fixed 0.5 dB Steps 3-12
3-19 Modulation Incrementing 3-12
3-20 Frequency Shift Keying (FSK) 3-13
3-21 RF Panel Control 3-13
3-22 Synthesized Digital Sweep 3-13
3-23 Store/Recall 3-15

TABLE OF CONTENTS (Cont)

Paragraph	Title	Page
3-24	IEEE 488 Programming	3-15
3-25	Remote GPIB Operation	3-15
3-26	GPIB Messages	3-15
3-27	Local-To-Remote Transition	3-15
3-29	Remote-To-Local Transition	3-16
3-30	Local Lockout	3-17
3-31	Addressing The 380	3-17
3-32	Programming Examples	3-20
3-33	Sending The Status Byte Message	3-22
3-34	Parallel Poll Interface Function	3-22
3-39	Fast Learn Function	3-23
3-44	BCD Parallel Programming	3-25

CHAPTER 4 — PERFORMANCE TESTS

Paragraph	Title	Page
4-1	Introduction	4-1
4-4	Required Test Equipment	4-1
4-6	Frequency Accuracy	4-2
4-7	Spectral Purity	4-4
4-8	Harmonics and Subharmonics	4-4
4-9	Spurious Responses	4-4
4-10	Signal-to-Phase Noise Ratio	4-5
4-11	Output Level Accuracy and Leveling	4-7
4-12	AM Modulation	4-8
4-13	FM Modulation	4-8
4-14	Phase Modulation	4-9

CHAPTER 5 — SYSTEM CALIBRATION AND ADJUSTMENTS

Paragraph	Title	Page
5-1	Introduction	5-1
5-5	Mainframe	5-1
5-6	Power Supply Voltage	5-1
5-7	Sweep Output Voltage	5-2
5-8	24/33 MHz Oscillator	5-2
5-9	10 MHz Frequency Standard (Option 002 or 003)	5-3
5-10	RF Sections 180, 1800 and 2000 MHz Adjustments	5-4
5-11	VHF Oscillator A5	5-4
5-12	Doubler Drive Level Adjustment 1800 and 2000 MHz RF Sections	5-5
5-13	Output Level and Amplitude Modulation Adjustments	5-6
5-15	Output Level RF Front Panel Control, 180 MHz RF Section	5-6
5-16	Amplitude Modulation Linearity, 180 MHz RF Section	5-7
5-17	Output Level, RF Front Panel Control, 1800 and 2000 MHz RF Sections	5-8
5-18	Amplitude Modulation Linearity 1800 and 2000 MHz RF Sections	5-9
5-19	AM Meter Calibration	5-10
5-20	Keyboard Calibration of Output Level and AM 180, 1800 and 2000 MHz RF Sections	5-10

TABLE OF CONTENTS (Cont)

Paragraph	Title	Page
5-21	PM 3602 Modulator Adjustments	5-13
5-22	Description	5-13
5-23	400 Hz and 1000 Hz Internal Oscillator	5-13
5-24	Modulation Meter Calibration	5-14
5-25	FM Phase Lock Loop Adjustment	5-14
5-26	FM Calibration	5-15
5-27	Stereo Separation Adjustment	5-16
5-28	Phase Modulation Calibration	5-17

CHAPTER 6 — MAINTENANCE

Paragraph	Title	Page
6-1	Introduction	6-1
6-3	Principles of Operation	6-1
6-4	Synthesized Signal Generator Mainframe	6-1
6-12	Frequency Extender	6-8
6-19	Troubleshooting	6-9
6-20	Synthesized Signal Generator Mainframe	6-9
6-21	Frequency Extender	6-9
6-22	Repair	6-9
6-25	Front Panel Assembly A1	6-10
6-27	Keyboard Assembly A1A1	6-10
6-28	Keyswitch Arrays	6-10
6-29	Numeric Indicators	6-10
6-32	LED Latches	6-10
6-37	Encoder Board Assembly A1A2	6-41
6-38	Key Encoders (U3, U5)	6-41
6-41	Keyboard Interrupt Generator (U2, U7)	6-41
6-45	Tuning Interrupt Generator	6-42
6-49	FSK/EXT Interrupt Generator	6-42
6-52	Reset Control	6-45
6-55	Display Address Decoders	6-45
6-58	Display Data Buffer	6-51
6-62	Resolution Control	6-51
6-64	LOC/REM Generator	6-51
6-66	Lower and Higher Order BCD Section	6-52
6-70	Lower Order BCD A2	6-55
6-72	1 kHz Decade Board A2A1	6-55
6-78	0.1 to 100 Hz BCD Decade Boards A2A2 Through A2A5	6-59
6-79	Higher Order BCD A4	6-59
6-81	BCD-1 Board A4A1	6-59
6-82	BCD-2 Board A4A2	6-59
6-83	BCD-4 Board A4A3	6-59
6-84	BCD-8 (No. 1) Board A4A4	6-64
6-85	BCD-8 (No. 2) Board A4A5	6-64
6-86	Buffer Amplifier A4A6	6-64
6-87	64/65 MHz Switches A4A7 Through A4A10	6-64

TABLE OF CONTENTS (Cont)

Paragraph	Title	Page
6-88	10 kHz BCD Board A4A11	6-64
6-93	Fixed Frequency Generator A5	6-67
6-95	Fixed Frequency Input Board A5A1	6-70
6-96	10 MHz Output Amplifier A5A2	6-70
6-97	60 MHz Generator A5A3	6-70
6-98	65 MHz Generator A5A4	6-70
6-99	64 MHz Generator A5A5	6-70
6-100	35/35.5 MHz Board A5A6	6-80
6-102	Power Supply A11	6-80
6-104	Rear Panel Assembly A12	6-80
6-106	Filter/Regulator Assembly A11	6-108
6-108	Filter Board A11A1	6-109
6-109	5.2V Regulator A11A2	6-109
6-112	-12 V Regulator A11A3	6-110
6-113	Logic and Power Distribution A14	6-110
6-115	MPU Assembly A15	6-116
6-117	MPU Board Assembly A15A1	6-116
6-118	Microprocessor Unit U20	6-116
6-119	MPU Signal Description	6-118
6-120	Direct Memory Access (DMA) U17	6-118
6-122	Device Operation	6-118
6-128	Initialization	6-123
6-129	Transfer Mode	6-123
6-131	Input/Output Functions	6-138
6-132	DMAC Registers	6-138
6-133	Timing Generator	6-138
6-134	Oscillator (Y1, C4, R4, L1, C3)	6-138
6-135	Signals Ø2 + STB, Ø2-STB	6-145
6-137	Data Bus Enable (DBE)	6-146
6-140	Clock Oscillator Board P/O A15A1	6-149
6-147	Address Decoder	6-149
6-151	Random Access Memory (RAM)	6-153
6-154	Read Only Memory (ROM)	6-153
6-158	Priority Interrupt Controller (PIC)	6-155
6-164	Data Latches for Attenuation and Modulation Programming Bits	6-157
6-167	Power Down Interrupt Generator	6-157
6-169	Latch Board Assembly A15A2	6-159
6-170	Latch Data Buffer	6-159
6-171	Latch Address Decoder (U22)	6-159
6-172	Primary Frequency Latches (U1, 3, 9, 7, 11, 14)	6-159
6-173	Secondary Frequency Latches (U2, 4, 8, 10, 12, 15)	6-159
6-174	Primary Sweep Latch (U17)	6-159
6-175	Secondary Sweep Latch (U19)	6-159
6-176	Sweep Voltage Generator (U23, U5)	6-160
6-178	Strobe Generator	6-160

TABLE OF CONTENTS (Cont)

Paragraph	Title	Page
6-186	GPIB Board Assembly A15A3	6-169
6-187	General Description of the IEEE Standard 488-1978	6-169
6-188	Bus Line Callouts	6-170
6-189	General Purpose Interface Adapter (GPIA) U13	6-171
6-191	GPIB/GPIA Interface Bus Signals	6-171
6-192	GPIA/MPU Interface Signals	6-171
6-193	Transfer Logic	6-177
6-194	Transfer Request Logic (U12, 6, 14, 15, 3, 11)	6-177
6-201	Linefeed, EOI and L Decode Circuit	6-183
6-202	Bus Transceivers (U1, 2, 7, 8)	6-184
6-203	Address Switch Register (S1, U5, U16)	6-184
6-204	Parallel Poll Bit Register	6-184
6-205	Data Buffer	6-184
6-207	24/33 MHz Oscillator A6	6-185
6-209	24/33 MHz Oscillator A6A1	6-185
6-213	Isolator Divider A6A2	6-185
6-214	Isolator/Amplifier A6A3	6-186
6-215	366 MHz Filter Converter A7	6-186
6-217	366 MHz Filter Converter Input Board A7A1	6-186
6-218	366 MHz Filter Converter Output Board A7A2	6-192
6-219	366 MHz Bandpass Filter	6-192
6-220	361/370 MHz Filter Amplifier A8	6-192
6-222	361/370 MHz Input Board A8A1	6-192
6-223	361/370 MHz Output Board A8A2	6-192
6-224	361/370 MHz Bandpass Filter	6-192
6-225	330-331 MHz Filter Amplifier A9	6-192
6-227	330-331 Filter Amplifier Input Board A9A1	6-202
6-228	330-331 MHz Filter Amplifier Output Board A9A2	6-202
6-229	330-331 MHz Bandpass Filter	6-202
6-230	High Frequency Subassembly A10	6-202
6-232	337 MHz Oscillator/Isolator A10A1	6-202
6-234	337 MHz Isolator Board A10A2	6-202
6-236	30-40 MHz Bandpass Filter A10A3	6-204
6-237	330.5 MHz Power Amplifier A10A4	6-204
6-239	1-5 MHz Comb Generator A10A5	6-204
6-243	29 MHz Filter Converter A10A6	6-210

CHAPTER 7 — REPLACEABLE PARTS LIST

Paragraph	Title	Page
7-1	Introduction	7-1

LIST OF ILLUSTRATIONS

Figure	Title	Page
1-1	380K11 Synthesized Signal Generator	xii
1-2	Frequency Extender Installed in Mainframe	1-13
1-3	Service Kit	1-14
2-1	Frequency Extender Installation	2-2
2-2	Rack Mounting Adapter Kit (Option 006)	2-6
2-3	Slide Mounting Adapter Kit (Option 007)	2-7
3-1	Front Panel Controls and Indicators	3-2
3-2	Rear Panel Controls and Connectors	3-8
4-1	Frequency Accuracy Test Setup	4-2
4-2	Phase Noise Test Setup	4-5
4-3	Modulation Test Setup	4-8
6-1	Synthesized Signal Generator Mainframe, Functional Block Diagram	6-3
6-2	Frequency Extender, Functional Block Diagram	6-8
6-3	Frequency Synthesizer Mainframe, Troubleshooting Chart	6-11
6-4	Frequency Synthesizer Mainframe, Servicing Block Diagram	6-13
6-5	Digital Subsystem, Interconnection Diagram	6-15
6-6	Frequency Synthesizer Mainframe, Subassembly Locations	6-19
6-7	Frequency Extender, Troubleshooting Chart	6-21
6-8	Frequency Extender, Servicing Block Diagram	6-23
6-9	Frequency Extender, Subassembly Locations	6-25
6-10	Integrated Circuits	6-27
6-11	Front Panel Assembly A1	6-29
6-12	Keyboard Controller Subsystem, Block Diagram	6-31
6-13	Keyboard A1A1, Block Diagram	6-33
6-14	Keyboard A1A1, Component Locations	6-35
6-15	Keyboard A1A1, Schematic Diagram	6-37
6-16	Encoder A1A2, Block Diagram	6-43
6-17	Encoder A1A2, Component Locations	6-46
6-18	Encoder A1A2, Schematic Diagram	6-47
6-19	BCD Decades, Block Diagram	6-53
6-20	Lower Order BCD Assembly A2, Interconnecting Diagram	6-57
6-21	Lower Order BCD Assembly A2	6-60
6-22	1-kHz Decade Board A2A1, Schematic Diagram	6-61
6-23	1-kHz Decade Board A2A1, Component Locations	6-63
6-24	0.1 to 100 Hz BCD Decade Boards A2A2-A2A5, Schematic Diagram	6-65
6-25	0.1 to 100 Hz BCD Decade Boards A2A2-A2A5, Component Locations	6-68
6-26	Higher Order BCD Assembly A4	6-69
6-27	BCD Boards A4A1-A4A4, Schematic Diagram	6-71
6-28	BCD-1 Board A4A1, Component Locations	6-73
6-29	BCD-2 Board A4A2, Component Locations	6-74
6-30	BCD-4 Board A4A3, Component Locations	6-75
6-31	BCD-8-1 Board A4A4, Component Locations	6-76
6-32	BCD-8 Board A4A5, Schematic Diagram	6-77
6-33	BCD-8-2 Board A4A5, Component Locations	6-79
6-34	Buffer Amplifier A4A6 and 64/55 MHz Switches A4A7-A4A10 Schematic Diagram	6-81

LIST OF ILLUSTRATIONS (Cont)

Figure Title Page

6-35 Buffer Amplifier A4A6, Component Locations 6-83
6-36 64/65 MHz Switches A4A7-A4A10, Component Locations. 6-84
6-37 10 kHz BCD Board A4A11, Schematic Diagram 6-85
6-38 10 kHz BCD Board A4A11, Component Locations 6-87
6-39 Fixed Frequency Generator A5 6-89
6-40 Fixed Frequency Input Board A5A1, 10 MHz Output Amplifier A5A2, and 60 MHz Generator A5A3, Schematic Diagram 6-91
6-41 Fixed Frequency Input Board A5A1, Component Locations 6-93
6-42 10 MHz Output Amplifier A5A2, Component Locations. 6-94
6-43 60 MHz Generator A5A3, Component Locations 6-95
6-44 65 MHz Generator A5A4, Schematic Diagram 6-97
6-45 65 MHz Generator A5A4, Component Locations 6-99
6-46 64 MHz Generator A5A5 and 35/35.5 MHz Board A5A6, Schematic Diagram . 6-101
6-47 64 MHz Generator A5A5, Component Locations 6-103
6-48 30/35.5 MHz Board A5A6, Component Locations 6-104
6-49 Rear Panel Assembly A12 and Filter/Regulator A11, Schematic Diagram . . . 6-105
6-50 Rear Panel Assembly A12, Component Locations 6-107
6-51 Power Supply Motherboard A11A4 6-108
6-52 Filter Board A11A1, Component Locations 6-109
6-53 5.2 Volt Regulator A11A2, Component Locations 6-111
6-54 -12 Volt Regulator A11A3, Component Locations 6-112
6-55 Logic and Power Distribution Board A14, Schematic Diagram. 6-113
6-56 Logic and Power Distribution Board A14, Component Locations 6-115
6-57 MPU Assembly A15 6-117
6-58 MPU PC Board A15A1, Block Diagram 6-125
6-59 MPU PC Board A15A1, Component Locations 6-127
6-60 MPU PC Board 15A1, Schematic Diagram 6-129
6-61 Interrupt, Timing Diagram 6-137
6-62 TSC Steal Mode, Timing Diagram 6-138
6-63 DBE Generator, Functional Logic Diagram 6-147
6-64 Time Relations, Diagram 6-148
6-65 1 MHz Clock Oscillator P/O A15A1, Component Locations 6-150
6-66 1 MHz Clock Oscillator P/O A15A1, Schematic Diagram. 6-151
6-67 Address Decoder Functional Logic Diagram. 6-154
6-68 Priority Interrupt Controller (PIC), Functional Logic Diagram 6-156
6-69 Power-Down Interrupt Generator, Functional Logic Diagram 6-158
6-70 Latch PC Board A15A2, Block Diagram 6-161
6-71 Latch PC Board A15A2, Component Locations 6-163
6-72 Latch PC Board A15A2, Schematic Diagram 6-165
6-73 GPIB PC Board A15A3, Block Diagram 6-175
6-74 GPIC PC Board A15A3, Component Locations 6-178
6-75 GPIB PC Board A15A3, Schematic Diagram 6-179
6-76 Power Supply A15PS1, Schematic Diagram 6-181
6-77 24/33-MHz Oscillator A6, Schematic Diagram 6-187
6-78 24/33 MHz Oscillator A6 6-189
6-79 24/33 MHz Oscillator Board A6A1, Component Locations 6-190

LIST OF ILLUSTRATIONS (Cont)

Figure	Title	Page
6-80	Isolator/Divider Board A6A2, Component Locations	6-191
6-81	Isolator/Amplifier Board A6A3, Component Locations	6-191
6-82	366 MHz Filter Converter A7 and 330/331 Filter Amplifier A9, Schematic Diagram	6-193
6-83	366 MHz Filter Converter A7	6-195
6-84	366 MHz Filter Converter Input Board A7A1, Component Locations	6-196
6-85	366 MHz Filter Converter Output Board A7A2, Component Locations	6-196
6-86	361/370 MHz Filter Amplifier A8, Schematic Diagram	6-197
6-87	361/370 MHz Filter Amplifier A8	6-199
6-88	361/370 MHz Filter Amplifier Input Board A8A1, Component Locations	6-200
6-89	361/370 MHz Filter Amplifier Output Board A8A2, Component Locations	6-200
6-90	330-331 MHz Filter Amplifier A9	6-201
6-91	330-331 MHz Filter Amplifier Input Board A9A1, Component Locations	6-203
6-92	330-331 MHz Filter Amplifier Output Board A9A2, Component Locations	6-203
6-93	337 MHz Oscillator and Isolator Boards A10A1 and A10A2, Schematic Diagram	6-205
6-94	High Frequency Subassembly A10	6-207
6-95	337 MHz Oscillator/Isolator Board A10A1, Component Locations	6-208
6-96	337 MHz Isolator Board A10A2, Component Locations	6-209
6-97	30-40 MHz Bandpass Filter A10A3 and 330.5 MHz Power Amplifier A10A4, Schematic Diagram	6-211
6-98	30-40 MHz Bandpass Filter Board A10A3, Component Locations	6-213
6-99	330.5 MHz Power Amplifier Board A10A4, Component Locations	6-213
6-100	1-5 MHz Comb Generator A10A5 and 29 MHz Filter Converter A10A6, Schematic Diagram	6-215
6-101	1-5 MHz Comb Generator A10A5, Component Locations	6-217
6-102	29 MHz Filter Converter A10A6, Component Locations	6-218
7-1	380K11 Mainframe and 3600E1 Frequency Extender	7-1

LIST OF TABLES

Table	Title	Page
1-1	380 Synthesizer Configurations and Available Options	1-2
1-2	General Specifications	1-4
1-3	System Specifications	1-7
1-4	Service Kit Part No. 299252	1-15
1-5	Recommended Test Equipment	1-16
1-6	Mainframe Assemblies and Subassemblies	1-17
1-7	Frequency Extender Assemblies and Subassemblies	1-18
3-1	Front Panel Controls and Indicators	3-3
3-2	Rear Panel Controls and Connectors	3-9
3-3	Message Reference Table	3-16
3-4	IEEE Notations	3-18
3-5	Programming Codes	3-19
3-6	Parallel Poll	3-23
3-7	Fast Learn Coding	3-23
3-8	Fast Learn Mode Packed BCD Conversion Table Decimal to BCD Byte	3-25
4-1	Test Equipment Required	4-1
5-1	Nominal Oscillator Frequencies	5-3
5-2	VHF Oscillator Frequencies	5-4
6-1	Plug-In Mainframe Interface (PMI) Wire List	6-5
6-2	BCD Switch Coding	6-55
6-3	MPU Signal Descriptions	6-119
6-4	Input/Output Functions	6-139
6-5	DMAC Registers	6-141
6-6	Timing Generator U26 Pin Functions	6-146
6-7	Bus Line Callouts	6-170
6-8	GPIB Interface Signals	6-172
6-9	GPIA/MPU Interface Signals	6-173
6-10	BCD Output Frequencies	6-186
6-11	Prom A10A5U1 Truth Table	6-204
7-1	Federal Supply Code Manufacturer	7-2

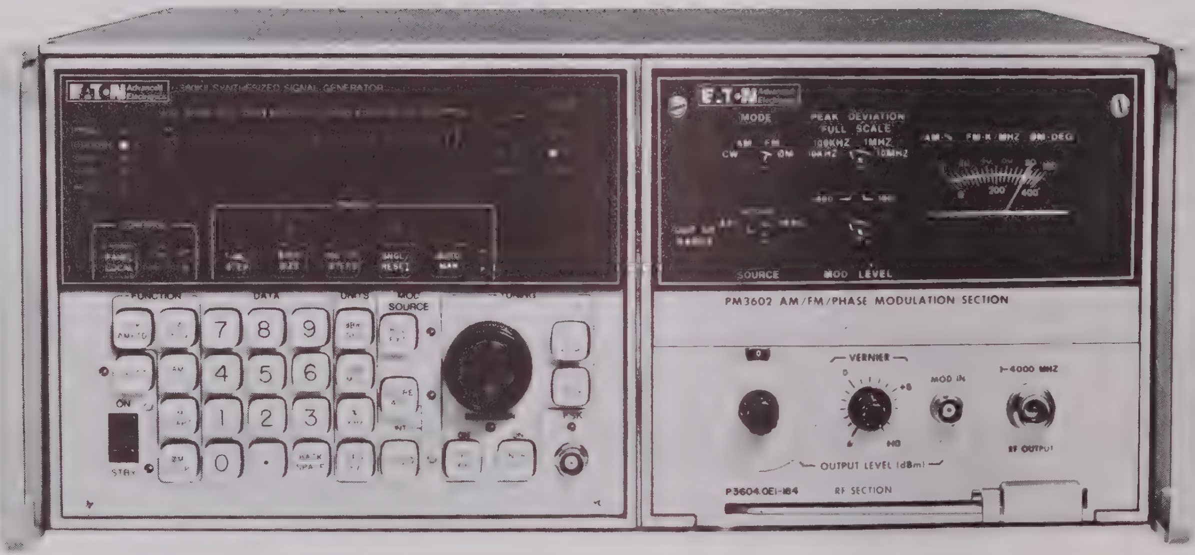


Figure 1-1. 380K11 Synthesized Signal Generator

CHAPTER 1

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The 380K11 Mainframe and 3600E1 Frequency Extender (Figure 1-1) are used with the P3600 Series RF Sections and PM3600 Series Modulation Sections. When fully assembled, these items make up a 380 Direct Synthesized Signal Generator whose frequency range depends upon the RF Section installed, with modulation capabilities determined by the specific Modulation Section in use. Refer to Table 1-1 for a complete listing of 380 Direct Synthesized Signal Generators and the options that are available to the user.

1-3. This manual contains the following information for the 380K11 Mainframe and the 3600E1 Frequency Extender and is divided into seven chapters as follows:

Chapter 1, GENERAL INFORMATION, provides brief physical and functional descriptions of the mainframe and frequency extender, 380 RF specifications, a list of component subassemblies, and a list of test equipment required for maintenance.

Chapter 2, INSTALLATION, provides information necessary for unpacking, initial turn-on, and initial checkout.

Chapter 3, OPERATION, provides information on how to operate the mainframe and frequency extender in conjunction with the RF section and modulation section to obtain a desired output.

Chapter 4, PERFORMANCE TESTS, provides equipment requirements and preliminary operations and performance tests.

Chapter 5, SYSTEM CALIBRATION AND ADJUSTMENTS, contains information to properly adjust and align the instrument.

Chapter 6, MAINTENANCE, provides information necessary to troubleshoot, repair, and adjust the mainframe and frequency extender.

Chapter 7, REPLACEABLE PARTS LIST, provides a list of parts contained in the mainframe and the frequency extender.

1-4. DESCRIPTION

1-5. **MAINFRAME.** The 380K11 Mainframe is 7 inches high, 16 3/4 inches wide, 25 1/2 inches deep and weighs 68 pounds. It produces frequencies in the range of 35 to 35.999999 MHz in steps as small as 0.1 Hz. The 3600E1 Frequency Extender adds 1 MHz increment to the 35 - 36 MHz output of the mainframe, covering 30 to 40 MHz. The 30 to 40 MHz output contains step sizes from 0.1 Hz (depending on the option) to 1 MHz. General specifications for the 380 Series are listed in Table 1-2 and the RF Specifications are listed in Table 1-3. Any of the RF Sections take this input, add the more significant steps and generate the RF frequency within its range.

TABLE 1-1. 380 SYNTHESIZER CONFIGURATIONS AND AVAILABLE OPTIONS

SYNTHESIZER CONFIGURATION	MODEL							
	380	380M	381	381M	382	382M	384	384M
380K11 Mainframe	●	●	●	●	●	●	●	●
3600E1 Frequency Extender	●	●	●	●	●	●	●	●
P360180E1 180 MHz RF Section	●	●						
P3601.8E1 1800 MHz RF Section			●	●				
P3602.0E1 2000 MHz RF Section					●	●		
P3604.0E1 4000 MHz RF Section							●	●
PM3601 AM Modulation	●		●		●		●	
PM3602 AM/FM/ϕModulation		●		●		●		●
AVAILABLE SYNTHESIZER OPTIONS								
Option 001, Increased Resolution	●	●	●	●	●	●	●	●
Option 002, Frequency Standard 3 X 10^{-8}	●	●	●	●	●	●	●	●
Option 003, Frequency Standard 1 X 10^{-9}	●	●	●	●	●	●	●	●
Option 004, 50-400 Hz Operation	●	●	●	●	●	●	●	●
Option 006, Rack Mount Adapter	●	●	●	●	●	●	●	●
Option 007, Slide Adapter Kit	●	●	●	●	●	●	●	●
Option 008, Transit Case	●	●	●	●	●	●	●	●
Option 012, 10kHz option for 2 GHz RF Section					●	●		
Option 181, 150 dB Attenuator	●	●						
Option 182, 130 dB Attenuator			●	●				
Option 183, 130 dB Attenuator					●	●		
Option 184, 130 dB Attenuator							●	●
Service Accessory 299252	●	●	●	●	●	●	●	●

1-6. All frequencies are derived from a reference input. The reference can be an externally applied 5 or 10 MHz signal, or from an optional internal 10 MHz crystal controlled, oven-stabilized source. Two internal crystal options are available.

1-7. Frequency control of the RF output is either by front panel keyboard entry or via remote control inputs. The remote control can be either parallel BCD or IEEE 488 Bus inputs.

1-8. **FREQUENCY EXTENDER.** The 3600E1 Frequency Extender consists of five modules installed in the lower deck of the mainframe. The unit adds 1 MHz steps to the 35 - 36 MHz output of the mainframe, and covers 30 to 40 MHz. There are no operator controls or external connections on the frequency extender. The frequency extender and its location in relation to the mainframe is illustrated in Figure 1-2.

1-9. **OPTIONS.** The following options are available for the synthesized signal generator and are described below:

- Option 001 adds one additional decade to the mainframe, improving the basic mainframe/frequency extender resolution to 0.1 Hz. Actual output resolution of the complete synthesizer is dependent upon the RF section installed.
- Option 002 provides an internal 10-MHz reference signal, crystal-controlled and oven-stabilized with an aging rate of 3 X 10^{-8}/24 hr (after 72 hours warm-up).
- Option 003 provides an internal 10-MHz reference signal, crystal-controlled and oven-stabilized with an aging rate of 1 X 10^{-9}/24 hr (after 72 hours warm-up).
- Option 004 provides for operation from a 50- to 400-Hz ac line frequency.
- Option 006 is a rack mounting adapter kit which provides the means to mount the 380 in a standard 19-inch rack. (Refer to paragraph 2-14.) Slides are not provided.
- Option 007 is a rack mount slide adapter kit which provides the means for mounting the 380 in a rack with chassis slides. (Refer to paragraph 2-15.)
- Option 181 provides control of the output amplitude over the range of +13 dBm to -150 dBm from the front panel.
- The 180 series options provide control of the output amplitude over the range of +10 dBm to -136 dBm from the front panel.
- Service Accessory (Refer to paragraph 1-10.)

1-10. **ACCESSORIES.** A service kit part number 299252 is available for maintenance purposes, see Figure 1-3. Table 1-4 lists the items contained in the kit. The items marked with an asterisk are applicable to the mainframe/frequency extender combination.

TABLE 1-2. GENERAL SPECIFICATIONS

Frequency Selection	Keyboard control of frequency. Knob tuning or UP/DOWN keys for incrementing frequency in decade values or in selected increments.
Frequency Indication	Indicates to 0.1 Hz resolution on an 11 digit LED display. Resolution of output frequency dependent upon frequency range and option.
Reference Oscillator	Internal: Options 002 and 003. External: 5 or 10 MHz, 0 dBm, 50 ohms, BNC rear panel input.
Reference Output	Rear panel BNC connector provides 10 MHz reference output at +3 dBm nominal, 50 ohms.
Output Level Selection	Keyboard control, knob tuning or UP/DOWN keys for incrementing level in 0.5 dB steps with the 180 series attenuator options. The RF panel controls can be activated (disabling the keyboard) allowing calibrated control knob and vernier adjustment of level. For instruments without attenuator options, level is adjusted with a calibrated vernier control on the RF panel.
Output Level Indication	LED display indicates level in dBm with 0.5 dB increments when AMPTD key is depressed for units with 180 series attenuator options. When the RF panel is activated, level is controlled by the RF panel controls. Level is then indicated on the calibrated control knobs, and the LED display is disabled for level.
Modulation Selection	Synthesized FSK function provides simulated 2-frequency FSK operation at rates up to 14k BITS/sec. Requires external TTL modulating signal into front panel BNC connector. Instruments with PM3601 External AM Modulator provide AM and pulse modulation capability without controls or indication. Instruments with PM3602 AM/FM/ϕM Modulator

TABLE 1-2. GENERAL SPECIFICATONS (Cont)

Modulation Selection (Cont)	(M Suffix) provide keyboard and programmed control of modulating mode, modulation source, and modulation level. Modulation level can be entered through the data keys, and changed in small increments by the tuning knob or the UP/DOWN keys. Increments are 0.5% steps for AM. For FM, increments are 50 Hz steps up to 10 kHz, 500 Hz steps from 10 kHz to 100 kHz, 5 kHz steps from 100 kHz to 1 MHz and 50 kHz from 1 MHz to 10 MHz. For phase modulations, increments are 0.5° up to 100° and 2.0° from 100° to 400°. Modulator panel controls can be enabled (disabling the keyboard) allowing continuous vernier adjustment of modulation level.
Modulation Indication	For instruments with M suffix, LED display indicates AM modulation in %, FM modulation in Hz, and Phase modulation in degrees, when the proper function key is depressed. Modulation meter on modulator panel also reads modulation level when entered from keyboard or modulation panel. LED modulation indication is disabled when the modulation panel control is enabled.
Store/Recall	Up to nine complete front panel setups can be stored.
Operating Temperature Range	0° to +50° C
Power Requirements	115 or 230V ± 10%, 48 to 66 Hz 300 VA
Size	178 mm H x 426 mm W x 648 mm D (7" x 16 3/4" x 25 1/2")
Weight	Net: 41 kg (91 lb.) Shipping: 52 kg (115 lb.)

TABLE 1-3. SYSTEM SPECIFICATIONS

FREQUENCY CHARACTERISTICS				
	380	381	382	384
Frequency Range	.01 - 179.99...MHz	1.0 - 1799.99...MHz	1.0 - 1999.99...MHz (.01 - 1999.99...MHz, 012 Option)	1.0 - 3999.99...MHz
Frequency Resolution	1 Hz 0.1 Hz with Main Frame Option 001	Output Frequency / Standard / Mainframe Option 001 < 60 MHz / 1 Hz / 0.1 Hz ≥ 60 MHz / 10 Hz / 1.0 Hz	Output Frequency / Standard / Mainframe Option 001 < 60 MHz / 1 Hz / 0.1 Hz ≥ 60 MHz / 10 Hz / 1.0 Hz	Output Frequency / Standard / Mainframe Option 001 < 60 MHz / 1 Hz / 0.1 Hz ≥ 60 MHz, / 10 Hz / 1.0 Hz ≥ 2000 MHz / 20 Hz / 2.0 Hz
Frequency Accuracy and Stability	Same as reference oscillator (±3 x 10^{-8}/24 hours with mainframe option 002, ±1 x 10^{-9}/24 hours with mainframe option 003(4)).			
Harmonics	<−30 dBc, 1.0 to 180 MHz	<−20 dBc, CF > 3 MHz (3) <−15 dBc, CF < 3 MHz (3)	<−20 dBc, CF > 3 MHz (3) <−15 dBc, CF < 3 MHz (3)	<−20 dBc, CF > 3 MHz (3) <−15 dBc, CF < 3 MHz (3)
Sub-Harmonics and Multiples (f/2, 3f/2, etc.)	N/A	< 900 MHz, N/A > 900 MHz, <−20 dBc	< 1000 MHz, N/A > 1000 MHz, <−20 dBc	< 1000 MHz, N/A > 1000 MHz, <−20 dBc
Signal to AM Noise (2)	> 84 dB	> 70 dB	> 70 dB	1.0 - 1999.99...MHz > 70 dB, 2000 - 3999.99...MHz > 64 dB
Signal to Phase Noise Ratio (2)	See Spectral Purity			

	Programming Mode	μP Time	Settling Time	Total Switching Time
Frequency Switching Time to be within 0.1 radians of final phase for 11-digits of frequency change	BCD Parallel	0	20μs (1)	20μs
	GPIB	19.9ms	20μs	20ms
	Fast Learn	84μs	20μs (1)	104μs

(1) For 1800, 2000 & 4000 MHz units, switching time is <80 microseconds for a frequency step from above 10 MHz to below 10 MHz. For 4000 MHz unit, switching time is <2ms for a frequency step across 2000 MHz. For 2000 MHz unit, Option 012, switching time is <25ms for a frequency step across 1 MHz.
(2) Measured in a ± 15 KHz band, excluding a ± 0.5 Hz band centered on the carrier.
(3) For output levels below +5 dBm with 182/183/184 attenuator options.
(4) After 72 hours warm-up.

SPECTRAL PURITY								
Guaranteed SSB Phase Noise in a 1 Hz BW, including effects of internal standard; options 002 or 003								
OUTPUT FREQUENCY				SPURIOUS SIGNALS	PHASE NOISE AT OFFSET FREQUENCY			
380 (MHz)	381 (MHz)	382 (MHz)	384 (MHz)	dBc (4)	1 kHz dBc/Hz	10 kHz dBc/Hz	100 kHz dBc/Hz	S/N dBc
.01 - 60	1 - 60	1 - 60 (3)	1 - 60	−100	−121	−126	−131	−78
—	60 - 80	60 - 100	60 - 100	−98	−119	−124	−129	−76
60 - 180	80 - 160	100 - 200	100 - 200	−92	−113	−118	−123	−70
—	160 - 320	200 - 400	200 - 400	−86	−107	−112	−117	−64
—	320 - 900	400 - 1000	400 - 1000	−80 (1)	−101	−106	−111	−58
—	900 - 1800	1000 - 2000	1000 - 2000	−74 (2)	−95	−100	−105	−52
—	—	—	2000 - 4000	−68	−89	−94	−99	−46

(1) (381) For 850-899.99...MHz, a spurious could appear from 1250-1350 MHz, <−60 dBc
(382/384) For 950-999.99...MHz, a spurious could appear from 1050-1150 MHz, <−60 dBc
(2) (381) For 1400-1480 MHz, a spurious could appear from 1150-1290 MHz, <−55 dBc. For 1700-1799.99...MHz, a spurious could appear from 1200-1450 MHz <−60 dBc. For 1600-1799.99...MHz, a spurious could appear 610 ± 1 MHz below the carrier, <−55 dBc.
(382, 384) For 1600-1680 MHz, a spurious could appear from 1470-1550 MHz, <−55 dBc. For 1900-1999.99...MHz, a spurious could appear from 1700-1950 MHz, <−60 dBc. For 1800-1999.99...MHz, a spurious could appear 610 ± 1 MHz below the carrier, <−55 dBc.
(3) .01-60 for 012 option.
(4) Spurious may appear between 200 KHz and 600 KHz, <−60 dBc.

TABLE 1-3. SYSTEM SPECIFICATIONS (Cont)

FREQUENCY MODULATION				
PM 3602 Modulation Section	380M .01 - 180 MHz	381M 1 - 1800 MHz	382M 1 - 2000 MHz(1)	384M 1 - 4000 MHz
Rate	20 Hz to 300 KHz			
FM Center Frequency Long Term Stability	Same as in CW Mode			
Maximum Peak Deviation	1 MHz	1 MHz, CF < 320 MHz 10 MHz, CF ≥ 320 MHz	1 MHz, CF < 400 MHz 10 MHz, CF ≥ 400 MHz	1 MHz, CF < 400 MHz 10 MHz, CF ≥ 400 MHz
Incidential AM	< −70 dB with 75 KHz peak deviation at a 1 KHz rate			
FM Distortion (Internal Oscillator)	< 2% up to 100 KHz dev.	< 2% up to 100 KHz dev. for CF < 320 MHz < 2% up to 1 MHz dev. for CF ≥ 320 MHz	< 2% up to 100 KHz dev. for CF < 400 MHz < 2% up to 1 MHz dev. for CF ≥ 400 MHz	< 2% up to 100 KHz dev. for CF < 400 MHz < 2% up to 1 MHz dev. for CF ≥ 400 MHz
Internal Oscillator	400 and 1000 Hz			
Full Scale Ranges	0 - 10 KHz, 0 - 100 KHz, 0 - 1 MHz, 0 - 10 MHz			
Indicated FM Accuracy (up to 20 KHz rates)	± 5% of Full Scale Range			
Remote Programming	Modes, range and level. External modulation input level is 1.0 VRMS for full scale.			
Programming Resolution	0.5% of Selected Range			

(1) 012 Option, .01 - 2000 MHz.

TABLE 1-3. SYSTEM SPECIFICATIONS (Cont)

AMPLITUDE MODULATION				
PM3601 or PM3602 (M Suffix) Modulators	380, 380M .01 - 180 MHz	381, 381M 1 - 1800 MHz	382, 382M 1 - 2000 MHz (.01 - 2000 MHz, 012 Opt)(5)	384, 384M 1 - 4000 MHz
Modulation Depth	0 - 95%(1)	0 - 90%(2)	0 - 90%(2)	0 - 90%(2)
Indicated AM Accuracy at 400 and 1000 Hz Rates (M - suffix only)	±5% of Full Scale (100%)	±5% of Full Scale (100%)	±5% of Full Scale (100%)	±5% of Full Scale (100%)
AM Distortion, THD 400 and 1000 Hz Rates				
30% AM	1.0%	1%(3)	1%(3)	1%(3)
90% AM	3.0%(1)	5%(3)	5%(3)	5%(3)
AM 3 dB Bandwidth 0 - 70%	DC - 200 Hz, CF < 0.4 MHz DC - 10 KHz, 0.4 ≤ CF < 4 MHz DC - 100 KHz, CF > 4 MHz	DC - 10 KHz, 2 MHz < CF < 10 MHz(4) DC - 80 KHz, CF ≥ 10 MHz(4)	DC - 10 KHz, 2 MHz < CF < 10 MHz(4) DC - 80 KHz, CF ≥ 10 MHz(4)	DC - 10 KHz, 2 MHz < CF < 10 MHz(4) DC - 80 KHz, CF ≥ 10 MHz(4)
0 - 90%	DC - 100 Hz, CF < 0.4 MHz DC - 5 KHz, 0.4 ≤ CF < 4 MHz DC - 50 KHz, CF ≥ 4 MHz	DC - 5 KHz, 2 MHz < CF < 10 MHz(2) DC - 50 KHz, CF ≥ 10 MHz(2)	DC - 5 KHz, 2 MHz < CF < 10 MHz(2) DC - 50 KHz, CF ≥ 10 MHz(2)	DC - 5 KHz, 2 MHz < CF < 10 MHz(2) DC - 50 KHz, CF ≥ 10 MHz(2)
Internal Oscillator (M - suffix only)	400 and 1000 Hz			
Remote Programming (M - suffix only)	Fully programmable, external modulation input level is 1.0 VRMS for full scale.			
Programming Resolution (M - suffix only)	0.5% Increments			

(1) For output levels below +9 dBm. With 181 ATTENUATOR OPTION for levels below +7 dBm.
(2) For output levels below +7 dBm. With 182/183/184 ATTENUATOR OPTIONS, for levels below +3 dBm. For 384, below 10 MHz, for levels below +2 dBm (184 option −2 dBm).
(3) For output levels between 0 and +7 dBm. With 182/183/184 OPTIONS, for level settings between −4 and +3 dBm. For 384, below 10 MHz, for levels between 0 and +2 dBm (184 option −5 and −2 dBm).
(4) For output levels between +2 and +7 dBm. With 182/183/184 OPTIONS, for levels between 0 and +5 dBm. For 384, below 10 MHz, for levels between 0 and +2 dBm (184 option −5 and 0 dBm).
(5) AM performance below 1 MHz (012 option) is not specified.

TABLE 1-3. SYSTEM SPECIFICATIONS (Cont)

	382M 1 - 2000 MHz (1)	384M 1 - 4000 MHz
Hz to 300 KHz		
ne as in CW Mode		
	1 MHz, CF < 400 MHz 10 MHz, CF ≥ 400 MHz	1 MHz, CF < 400 MHz 10 MHz, CF ≥ 400 MHz
KHz peak deviation at a 1 KHz rate		
MHz z	< 2% up to 100 KHz dev. for CF < 400 MHz < 2% up to 1 MHz dev. for CF ≥ 400 MHz	< 2% up to 100 KHz dev. for CF < 400 MHz < 2% up to 1 MHz dev. for CF ≥ 400 MHz
00 and 1000 Hz		
00 KHz, 0 - 1 MHz, 0 - 10 MHz		
of Full Scale Range		
modulation input level is 1.0 VRMS for full scale.		
% of Selected Range		

PHASE MODULATION				
PM 3602 Modulation Section	380M .01 - 180 MHz	381M 1 - 1800 MHz	382M 1 - 2000 MHz (1)	384M 1 - 4000 MHz
Rate	DC to 300 KHz			
Maximum Peak Deviation	100°, CF < 60 MHz 200°, CF ⩾ 60 MHz	100°, CF < 80 MHz 200°, 80 to 160 MHz 400°, CF ⩾ 160 MHz	100°, CF < 100 MHz 200°, 100 to 200 MHz 400°, CF ⩾ 200 MHz	100°, CF < 100 MHz 200°, 100 to 200 MHz 400°, CF ⩾ 200 MHz
ϕM Distortion (Internal Oscillator)	< 5%			
Internal Oscillator	400 and 1000 Hz			
Full Scale Ranges	0 - 100°, 0 - 400°			
Indicated Accuracy	± 5% of Full Scale Range			
Remote Programming	Mode, range and level. External modulation input level is 1.0 vrms for full scale.			
Programming Resolution	0.5% of Selected Range			
FSK MODULATION				
Maximum Bite Rate	14k Bits/Sec			
Maximum Deviation		Within Limits of Synthesizer Ranges		
Deviation Accuracy	Synthesizer Accuracy			
Resolution	Same as Synthesizer Resolution			
Remote Programming	Mode and Deviation			
External Modulation	TTL Levels, Edge Triggered			
PULSE MODULATION				
PM 3601 or PM 3602	380, 380M .01 - 180 MHz	381, 381M 1 - 1800 MHz	382, 382M(1) 1 - 2000 MHz	384, 384M 1 - 4000 MHz
Rise/Fall Time	< 5 μs			
On/Off Ratio	> 70 dB	> 30 dB	> 30 dB	> 30 dB
Input Level Required	0 to +5V under keyboard or remote control 0 to —5V under modulator panel control			

(1) 012 Option, .01 - 2000 MHz

TABLE 1-3. SYSTEM SPECIFICATIONS (Cont)

DIGITAL SWEEP AND REMOTE PROGRAMMING				
	380, 380M .01 - 180 MHz	381, 381M 1 - 1800 MHz	382, 382M 1 - 2000 MHz(1)	384, 384M 1 - 4000 MHz
Digital Sweep	Sweep Functions Start-Stop Sweep: Sweeps between two selected frequencies Step Size: Choice of 100 or 1000 points per sweep, or may be set to any value within the frequency resolution of the instrument up to 10,000 points. Sweep Speed: Internal, 1, 10, 100 ms/step. External 500 μs/step maximum. Sweep Output: 0 to 2V nominal stepped ramp, 1000 points maximum. BNC connection on rear panel. SW UNCAL LED indicates when sweep uses over 1000 points. Sweep Modes: Auto: Sweep repeats automatically Single: Single sweep activated by front panel keyboard. Manual: Sweep controlled by front panel knob or up/down keys.			
Remote Programming	Interface: IEEE Standard 488 or parallel TTL (BCD for Frequency and Level). Functions Controlled: All functions except the line switch are controlled and are programmable with the same accuracy and resolution as in keyboard mode. Output level is programmable only with 180 series attenuator options. Modulation is programmable only with M suffix models (Includes PM 3602 modulator). Mating Connector Types: (Not Supplied) Fast Switching Parallel TTL: Frequency: Amp Champ 229974-1 Modulation and Level: Amp Champ 552284-1 IEEE-488 Bus Cable: Amphenol Part Numbers 408-30111-301 (1 Meter Length) 408-30111-302 (2 Meter Length) 408-30111-302 (4 Meter Length)			

(1) .01 - 2000 MHz with 012 option.

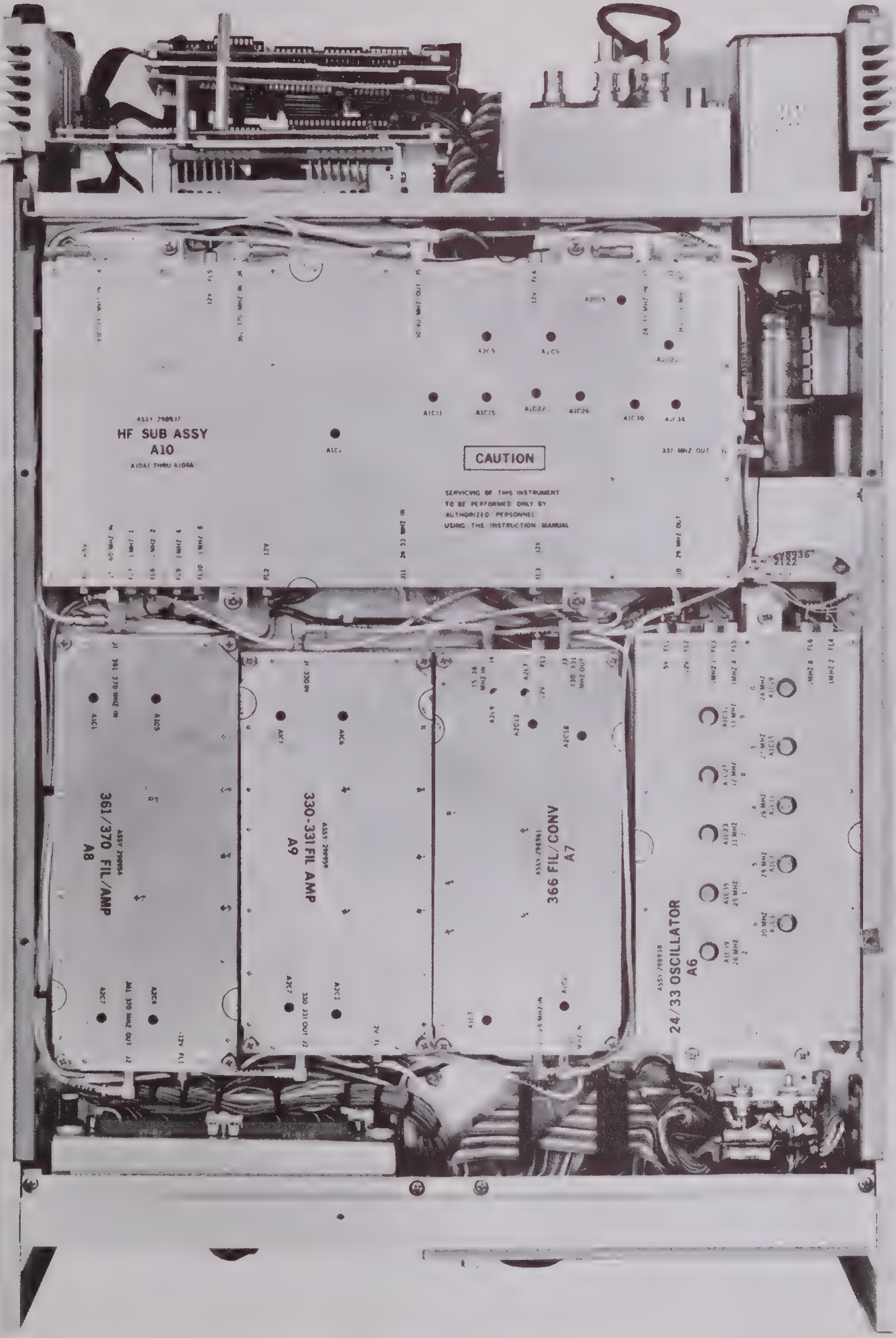


Figure 1-2. Frequency Extender Installed in Mainframe

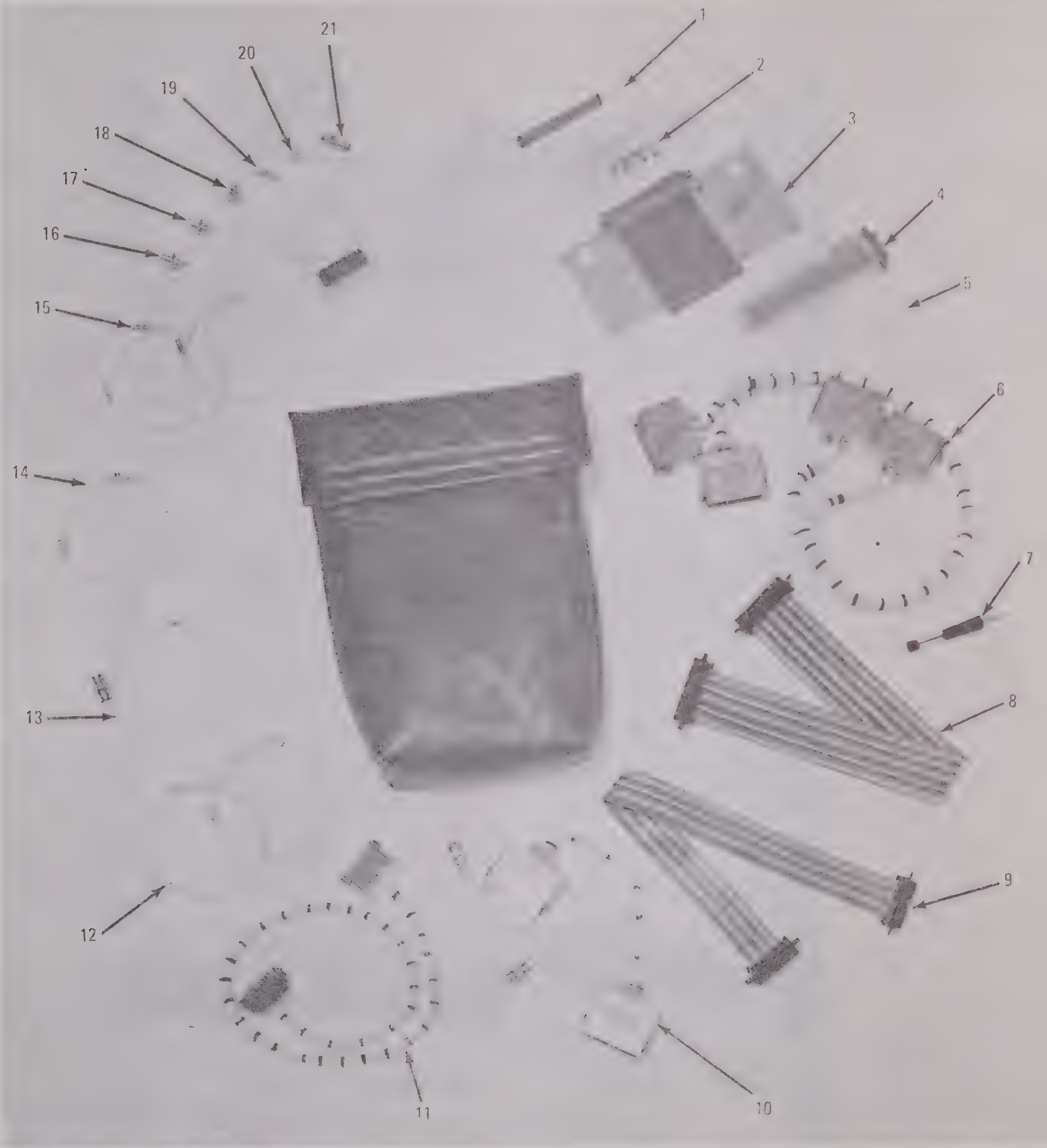


Figure 1-3. Service Kit

TABLE 1-4. SERVICE KIT PART NO. 299252

Item	Description	Part Number
	Pouch Assembly	299252-4
1	*Adjustment Tool Non-Metallic	293198-1
2	*Card Jumper, BCD	299225
3	*Card Extender, BCD	299545
4	*Card Extender, Power Supply	299547
5	*Adjustment Tool	293198-2
	Pouch PI Extender Cable	299252-4
6	Extender Cable Assembly	299822
7	Extraction Tool M Block	294291
8	Extender Cable MPU	296551-1
9	Extender Cable MPU	296551-2
	Pouch Jumper Cable	299252-6
10	*Cable Assembly, Jumper Mainframe	299821
	Pouch Assembly Modulation Extender Cable	299252-7
11	Cable Assembly Extender Modulation	299820
	Pouch Assembly RF Cable	299252-8
12	*Cable Assembly, Coaxial, SMB Plug to SMB Plug Quantity 2	299543-1
13	*Cable Assembly, Coaxial, SMB Plug to SMB Plug Quantity 2	299543-2
14	*Cable Assembly, Coaxial, SMB Right Angle Plug to SMB Right Angle Plug	299543-3
15	*Cable Assembly, Coaxial SMB Jack to SMB Plug, Quantity 2	299543-4
	Case Assembly, RF Adapter	299252-9
16	*Adapter BNC Female, SMB Jack	294676
17	*Adapter BNC Female, SMB Plug	294677
18	*Adapter SMB Tee	294678
19	Adapter Straight Jack/Jack	294652
20	Adapter Straight Plug/Plug	294653
21	Adapter OSM Jack to Type BNC Jack	294658

*Specifically required for mainframe/frequency extender maintenance

1-11. TEST EQUIPMENT. Table 1-5 lists the test equipment recommended for use in testing, adjusting, and servicing the 380 Direct Synthesized Signal Generator.

1-12. MAINFRAME SUBASSEMBLIES. The mainframe consists of nine major subassemblies. Table 1-6 lists the reference designator, title and part number of each subassembly.

1-13. FREQUENCY EXTENDER SUBASSEMBLIES. The frequency extender consists of five major subassemblies. Table 1-7 lists the reference designator, title and part number of each subassembly.

TABLE 1-5. RECOMMENDED TEST EQUIPMENT

Item	Specification	Recommended Model
Coaxial Attenuator	10 dB	Narda
Digital Voltmeter		Systron Donner Model 7004
Frequency Counter	300 Hz to 2 GHz	Systron Donner Model 6244A
Frequency Counter	300 Hz to 180 MHz	Dana Model 7720
Function Generator		Wavetek Model 180
Modulation Meter	1 MHz to 2 GHz	Dana Model 9008
Power Meter, RF	200 kHz to 200 MHz ± 0.2 dB	Boonton Model 42B
Prescaler	600 MHz ÷ 10, ÷ 100	Weston 1259
Service Kit	See Table 1-4 and Figure 1-3	AILTECH 299252
Spectrum Analyzer	.001 to 12.4 kHz 100 dB display range with preselection and variable persistence	AILTECH 757

TABLE 1-6. MAINFRAME ASSEMBLIES AND SUBASSEMBLIES

Reference Designation	Title	Part Number
A1	Front Panel Assembly	296389-001
A1A1	Keyboard Assembly	296306-001
A1A2	Encoder Board Assembly	296308-001
A1A3	Optical Encoder Assembly	296424-001
A2	Lower Order BCD Assembly	298933-002
*A2A1	1 kHz BCD Decade Board	299204-001
*A2A2 - A2A4	0.1 Hz to 100 Hz BCD Decade Boards	299214-001
*A2A5	0.1 Hz BCD Decade Board	299214-001
*A2A6	BCD Interconnecting Board	299203-001
*A2A5	Jumper Board	299225-001
A4	Higher Order BCD Assembly	298934-001
A4A1	100 kHz BCD-1 Board	298904-001
A4A2	100 kHz BCD-2 Board	298905-001
A4A3	100 kHz BCD-4 Board	298906-001
A4A4	100 kHz BCD-8/1 Board	298907-001
A4A5	100 kHz BCD-8/2 Board	298908-001
A4A6	Buffer Amplifier Board	298909-001
A4A7-A10	64/65 MHz Switch Board	298910-001
A4A11	10 kHz BCD Board	299248-001
A5	Fixed Frequency Generator Assembly	298935-001
A5A1	Input Board	298921-001
A5A2	10 MHz Output Board	298918-001
A5A3	60 MHz Generator Board	298919-001
A5A4	65 MHz Generator Board	298917-002
A5A5	64 MHz Generator Board	298915-001
A5A6	35/35.5 MHz Board	298926-001
A11	Power Supply Assembly	—
A11A1	Filter Board	298997-001
A11A2	+5.2 Volt Regulator Board	298998-001
A11A3	—12 Volt Regulator Board	299200-001
A11A4	Power Supply Motherboard	298928-001

*A2A1 through A2A5 are installed in module A2 but are not part of module A2.

TABLE 1-6. MAINFRAME ASSEMBLIES AND SUBASSEMBLIES (Cont)

Reference Designation	Title	Part Number
A12	Rear Panel Assembly	296407-001
A13	Frequency Standard	298648-001
A14	Logic and Power Distribution Board	299201-001
A15	MPU Assembly	296387-003
A15A1	MPU PC Board	296351-006
A15A2	Latch PC Board	296353-003
A15A3	GPIB PC Board	296355-001

TABLE 1-7. FREQUENCY EXTENDER ASSEMBLIES AND SUBASSEMBLIES

Reference Designation	Title	Part Number
A6	24/33 MHz Oscillator Assembly	298938-001
A6A1	24/33 MHz Oscillator Board	298949-001
A6A2	Isolator Divider Board	298952-001
A6A3	Isolator Amplifier Board	298953-001
A7	366 MHz Filter Converter Assembly	298961-001
A7A1	366 MHz Filter Converter Input Board	298962-001
A7A2	366 MHz Filter Converter Output Board	298963-001
A8	361/370 MHz Filter Amplifier Assembly	298954-001
A8A1	361/370 MHz Filter Amplifier Input Board	298955-001
A8A2	361/370 MHz Filter Amplifier Output Board	298956-001
A9	330/331 MHz Filter Amplifier Assembly	298959-001
A9A1	330/331 MHz Filter Amplifier Input Board	298965-001
A9A2	330/331 MHz Filter Amplifier Output Board	298966-001
A10	High Frequency Subassembly	298937-001
A10A1	337 MHz Oscillator Isolator Board	298995-001
A10A2	337 MHz Isolator Board	298996-001
A10A3	30/40 MHz Filter Amplifier Board	298901-001
A10A4	330 MHz Power Amplifier	298902-001
A10A5	1-5 MHz Comb Generator Board	298900-001
A10A6	29 MHz Filter Converter Board	298903-001

CHAPTER 2

INSTALLATION

2-1. INTRODUCTION

2-2. This chapter describes unpacking, preparation for use, initial turn-on and initial checkout of the 380K11 Mainframe with and without the 3600E1 Frequency Extender.

2-3. UNPACKING

2-4. No special instructions or precautions are necessary for unpacking the equipment except that reasonable care should be exercised to protect the instrument. When the instrument has been removed from the shipping container, remove the black plastic band securing the RF section in place.

2-5. PREPARATION FOR USE

2-6. If a complete synthesizer was ordered, all components have been assembled at the factory and all connections made prior to shipment. Paragraphs 2-7 through 2-12 describe installation procedures if various components are ordered separately.

2-7. **FREQUENCY EXTENDER INSTALLATION.** If the mainframe contains a frequency extender, all connections have been made at the factory. If a frequency extender is being added to a mainframe, refer to Figure 2-1 and proceed as follows. (This procedure requires a 5/16-inch spintight.)

a. Disconnect the ac line cord and turn the frequency synthesizer upside down.

b. Remove the bottom cover.

c. Disconnect two cables W23A10J5 and W10A7J4 from each other and remove the interconnecting adapter.

d. Install frequency extender and secure in place with eight nuts.

e. Make the following connections to the frequency extender:

Cable	Frequency Extender Connection
W18A7J2	A7J2
W24A10J10	A10J10
W23A10J5	A10J5
W14A10J7	A10J7
W10A7J4	A7J4

f. Replace the bottom cover.

g. Turn frequency synthesizer right side up.

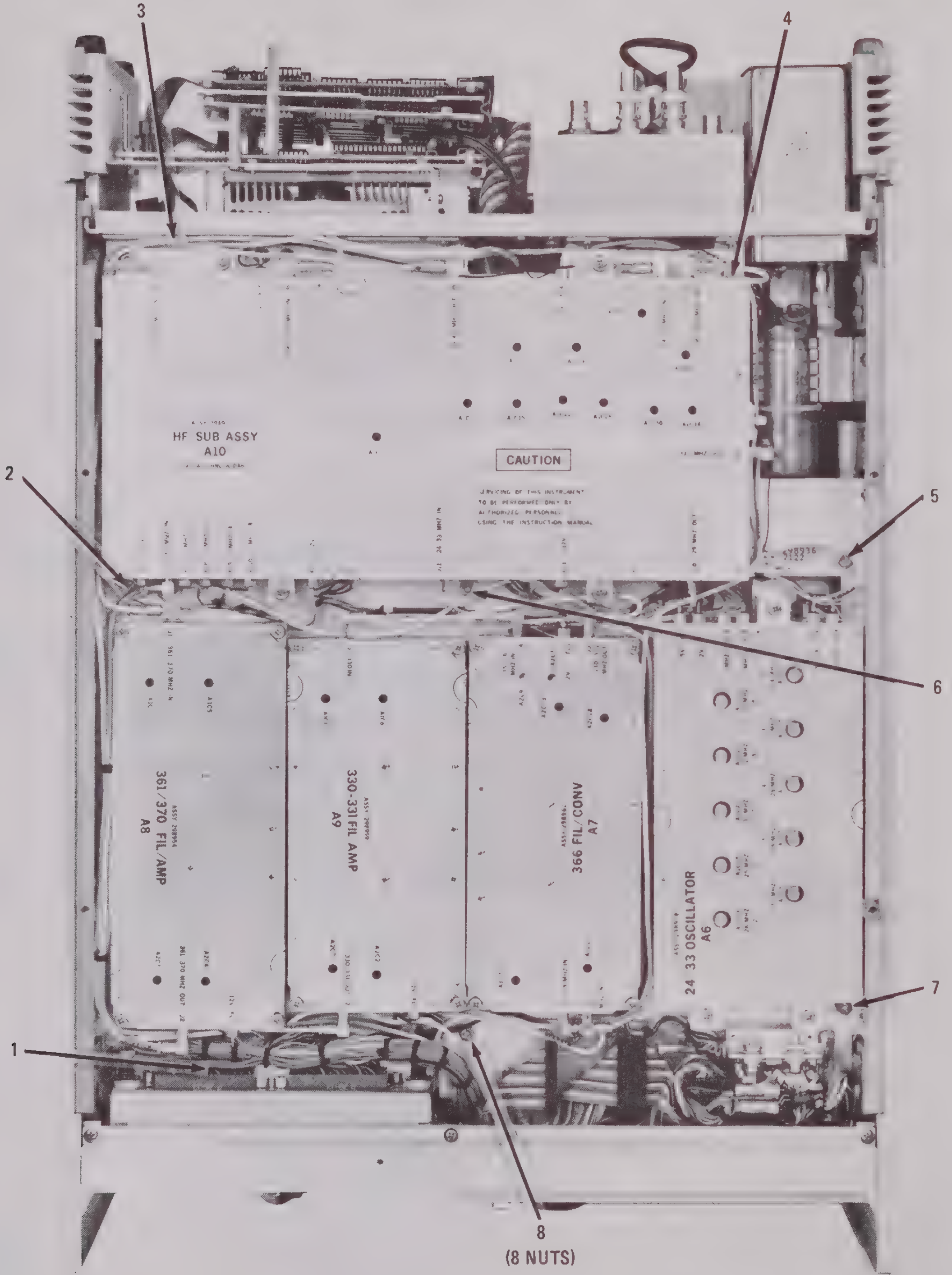


Figure 2-1. Frequency Extender Installation

2-8. FREQUENCY STANDARD INSTALLATION. If the optional internal frequency standard (Mainframe Option 002 or 003) is ordered separately, it is installed as follows. (This procedure requires a Phillips head screwdriver and a soldering iron.)

a. Disconnect ac line cord.

b. Remove the rear cover assembly.

c. Remove the frequency standard cover plate at right near corner of the mainframe.

d. Secure cover plate to oven with two Phillips head screws provided. Make certain the frequency adjustment screw is accessible through the adjustment hole.

e. Withdraw coiled cable and leads from inside mainframe.

f. Connect coaxial cable to SMA output connector of frequency standard.

g. Solder purple-white striped wire to feedthrough filter capacitor.

h. Solder black wire to ground lug under feedthrough filter capacitor.

i. Slip screw heads on top surface of oven through slots in bracket at top of well.

j. Slide the unit into mainframe until cover plate bottoms against rear panel. Secure with screws provided.

k. Connect BNC jumper cable between rear panel connectors marked, 10 MHz INT STD OUT and 5/10 MHz REF IN.

2-9. RF SECTION INSTALLATION/REMOVAL.

2-10. Install the RF section by performing the following procedure:

CAUTION

Do not attempt to assemble the RF section to a mainframe if the connector alignment pins are bent, since this could cause extensive damage to the plug-in connectors.

a. Carefully slide unit about halfway into slot provided on right side of mainframe.

b. Make certain that the locking lever is at about a 45 degree angle with the front panel and fully seat the unit. The locking lever should pivot in towards panel.

c. Lock plug-in by depressing lever until latch engages.

d. Connect two ribbon cables from mainframe to RF section connectors J4 and J5. When removing the RF section proceed as follows:

CAUTION

Disconnect the two ribbon cables from connectors J4 and J5 before removing the RF section from the mainframe.

e. Removal of the RF section is the reverse of steps a through d.

2-11. **MODULATION SECTION INSTALLATION.** If the RF section was ordered and shipped with a modulation section, the two units have been assembled at the factory prior to shipment. From an external viewpoint, the modulation section makes up the upper half of the RF section front panel. To install the modulation section proceed as follows.

2-12. The modulation section is best installed with the RF section either completely removed from or partially inserted in the mainframe. (No tools are required for the following procedures.)

a. Insert modulation interface connector P3 through front panel opening and seat the connector in mating block J3 on RF section. Secure connector by finger-tightening the captive thumbscrews on P3.

b. Place lower edge of modulation section panel on upper edge of RF section panel. Make certain the metal tab on modulation section panel is behind the RF section panel.

c. Pivot panel back into recess provided. Secure unit by finger-tightening captive thumbscrews on modulation section front panel.

d. On PM3602 it is also necessary to secure rear support bracket to the RF section with a number six screw, nut, and lockwasher.

2-13. RACK MOUNTING.

2-14. A rack mounting adapter kit (Option 006) is required to secure the AILTECH 380 Synthesized Signal Generator in a standard 19-inch rack. The kit consists of two right-angle brackets which bolt to the side of the unit. (See Figure 2-2.) Complete assembly instructions are provided with the kit.

CAUTION

A fully assembled AILTECH 380 Synthesized Signal Generator weighs 91 pounds. Two persons are required to lift the unit, and it must be supported in a rack by some means other than the rack mounting kit. Full length shelf brackets or suitable rack-mount chassis slides (paragraph 2-15 are recommended for support in a rack.

2-15. Rack mount slide adapter kit (Option 007) (Figure 2-3) provides a suitable means for mounting the AILTECH 380 Synthesized Signal Generator in a rack with chassis slides. (Slides are not provided with the kit.) The kit consists of two replacement side panels for the mainframe and instructions illustrating a typical rack mounting installation. The panels are designed to mate with the Jonathan Manufacturing Company 310-L-26 series slide.

2-16. INITIAL TURN-ON

2-17. The location and function of the controls, indicators and connectors on the mainframe are described in Chapter 3. Other controls, indicators, and connectors referenced in the following procedures are located on and described in the appropriate RF Section Instruction Manuals.

CAUTION

To prevent damage to the instrument, make line voltage selection before connecting line power. Also ensure that the line power cord is connected to a power circuit with a protective earth ground.

a. Set power PC card at rear of frequency synthesizer to 120 or 240 volts depending on power source being used. Use proper fuse as indicated.

b. Set ON/STBY switch on frequency synthesizer front panel to STBY.

c. Connect power cable at rear of frequency synthesizer to an uninterrupted source of 115/230-Vac, single-phase, 48- to 66-Hz power (50 to 400 Hz with Option 004). With the ON/STBY switch in STBY position the STBY LED will light. With the ON/STBY switch in ON position the LED will light and the display will indicate.

d. If the signal generator contains Option 002 or 003 (internal frequency standard), allow the unit to warmup for a minimum of 1 hour. (Refer to paragraph 3-5.)

e. With the ON/STBY switch to STBY position, all indicators except the STBY LED on the mainframe are blanked.

2-18. INITIAL CHECKOUT

2-19. After an initial warmup period of 1 hour, check that the signal generator is operating properly as follows:

a. If the unit is not equipped with an optional internal frequency standard (Option 002 or 003), connect a stable 5 or 10 MHz signal at 0 dBm to the rear panel BNC connector marked 5/10 MHZ REF IN.

b. Connect frequency counter to RF OUTPUT connector on front panel of RF section.

c. Connect REF OUTPUT at rear of synthesizer mainframe to external 10 MHz input of counter.

d. Set ON/STBY switch to ON position and check that the frequency counter and the front panel indicates 100 MHz (± 1 count). The 380 will initialize to 100 MHz, –20 dBm, CW mode anytime the power is connected and the unit is turned on.

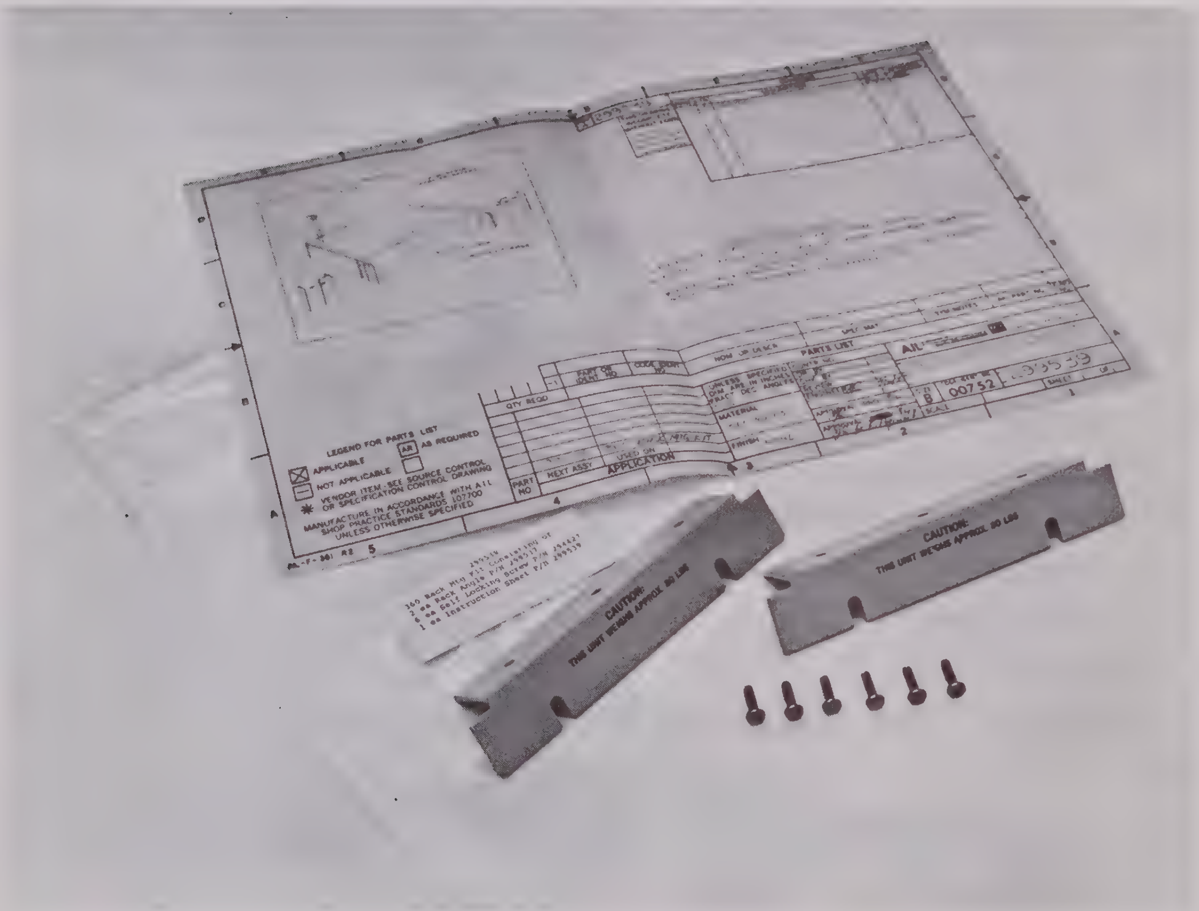
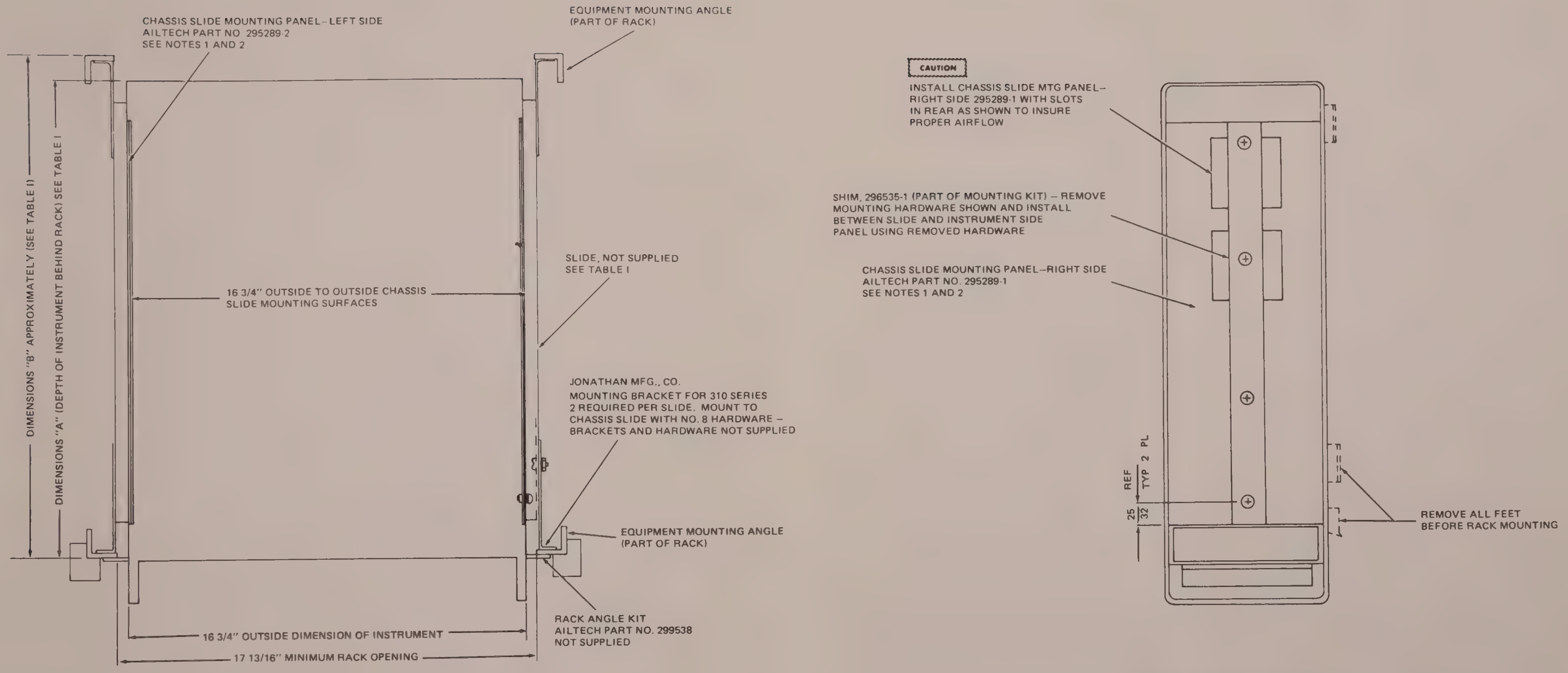

CAUTION:
THIS UNIT WEIGHS APPROX 80 LBS
CAUTION:
THIS UNIT WEIGHS APPROX 80 LBS

Figure 2-2. Rack Mounting Adapter Kit (Option 006)


CHASSIS SLIDE MOUNTING PANEL – LEFT SIDE
AILTECH PART NO 295289-2
SEE NOTES 1 AND 2
EQUIPMENT MOUNTING ANGLE
(PART OF RACK)
DIMENSIONS "B" APPROXIMATELY (SEE TABLE I)
DIMENSIONS "A" (DEPTH OF INSTRUMENT BEHIND RACK) SEE TABLE I
16 3/4" OUTSIDE TO OUTSIDE CHASSIS SLIDE MOUNTING SURFACES
SLIDE, NOT SUPPLIED
SEE TABLE I
JONATHAN MFG., CO.
MOUNTING BRACKET FOR 310 SERIES
2 REQUIRED PER SLIDE. MOUNT TO
CHASSIS SLIDE WITH NO. 8 HARDWARE –
BRACKETS AND HARDWARE NOT SUPPLIED
EQUIPMENT MOUNTING ANGLE
(PART OF RACK)
RACK ANGLE KIT
AILTECH PART NO. 299538
NOT SUPPLIED
16 3/4" OUTSIDE DIMENSION OF INSTRUMENT
17 13/16" MINIMUM RACK OPENING
CAUTION
INSTALL CHASSIS SLIDE MTG PANEL– RIGHT SIDE 295289-1 WITH SLOTS IN REAR AS SHOWN TO INSURE PROPER AIRFLOW
SHIM, 296535-1 (PART OF MOUNTING KIT) – REMOVE MOUNTING HARDWARE SHOWN AND INSTALL BETWEEN SLIDE AND INSTRUMENT SIDE PANEL USING REMOVED HARDWARE
CHASSIS SLIDE MOUNTING PANEL–RIGHT SIDE
AILTECH PART NO. 295289-1
SEE NOTES 1 AND 2
REF
TYP 2 PL
25
32
REMOVE ALL FEET BEFORE RACK MOUNTING

NOTE:

1. WHEN MOUNTING CHASSIS SLIDES THE CHASSIS SLIDE MOUNTING PANELS SHALL REPLACE THE STANDARD SIDE PANELS USING EXISTING HARDWARE.
2. CHASSIS SLIDE MOUNTING PANELS MAY BE MODIFIED BY THE CUSTOMER TO ADAPT SLIDES OTHER THAN THOSE ILLUSTRATED.

TABLE I

PRODUCT LINE	DIMENSION "A"	RECOMMENDED SLIDE AND APPROXIMATELY DIMENSION "B"		
		22" TRAVEL	25" TRAVEL	27" TRAVEL
360	20 1/2	JONATHAN MFG., CO. #310-L-18-22 DIMENSION "B" ≈ 21 5/8	JONATHAN MFG., CO. #310-L-24 DIMENSION "B" ≈ 25 5/8	JONATHAN MFG., CO. #310-L-26 DIMENSION "B" ≈ 28
380	23 1/2	–	–	JONATHAN MFG., CO. #310-L-26 DIMENSION "B" ≈ 28

Figure 2-3. Slide Mounting Adapter Kit (Option 007)

CHAPTER 3

OPERATION

3-1. INTRODUCTION

3-2. This chapter illustrates and describes the controls, indicators, and connectors of the AILTECH 380K11 Mainframe. It also provides operating instructions and a simple operating check which may be performed should the unit appear to malfunction.

3-3. CONTROLS, INDICATORS AND CONNECTORS

3-4. Figures 3-1 and 3-2 show the controls, indicators, and connectors on the front and rear panels of the 380K11 Mainframe. Tables 3-1 and 3-2 list the exact name of the control, and function.

3-5. REFERENCE OSCILLATOR STABILIZATION

3-6. The 380K11 Mainframe and 3600E1 Frequency Extender are used in conjunction with an appropriate P360 RF Section as a precision signal source. The frequency accuracy and precision is dependent upon an externally applied 5 or 10 MHz reference signal, or an optional, internal, oven-stabilized, 10-MHz crystal controlled oscillator. A minimum period of one hour is required for the oven to reach full operating temperature. The specified stability is obtained after the oscillator is on for a minimum of 72 hours. For this reason, the signal generator is provided with an ON/STBY switch rather than a power on-off switch. It is suggested that the unit be connected to an uninterrupted source of ac power and remain in the standby mode when not being used. In this manner, the 10-MHz crystal oscillator is maintained at constant temperature, and the signal generator is ready for immediate use without a long warmup period.

3-7. Before attempting to operate the signal generator using the internal reference oscillator, make certain the BNC jumper cable between the 10 MHz INT STD OUT and the REF IN jacks at the rear of the mainframe is in place.

3-8. OPERATORS MAINTENANCE

3-9. If the signal generator appears to malfunction, perform the following checks:

a. If both the STBY and ON LED indicators are inoperative (no ac power), check that the primary power source is turned on.

b. Check that the power cable is securely connected to the unit.

c. Check fuse at rear of unit and replace blown fuse. If fuse constantly blows, the unit requires more extensive repair. (See Chapter 6.)

d. If ac line power is applied but no output is available, check that the RF section is properly seated and locked in place and also check that the voltage selector PC card is in the proper position.

e. Check that an appropriate internal or external reference source is connected to the mainframe REF IN connector.

f. Check that the output cable being used is not damaged or incorrectly connected. If an output is still not available, the unit requires more extensive repair. (See Chapter 6.)

g. Check two connectors J4 and J5 on rear of RF section.

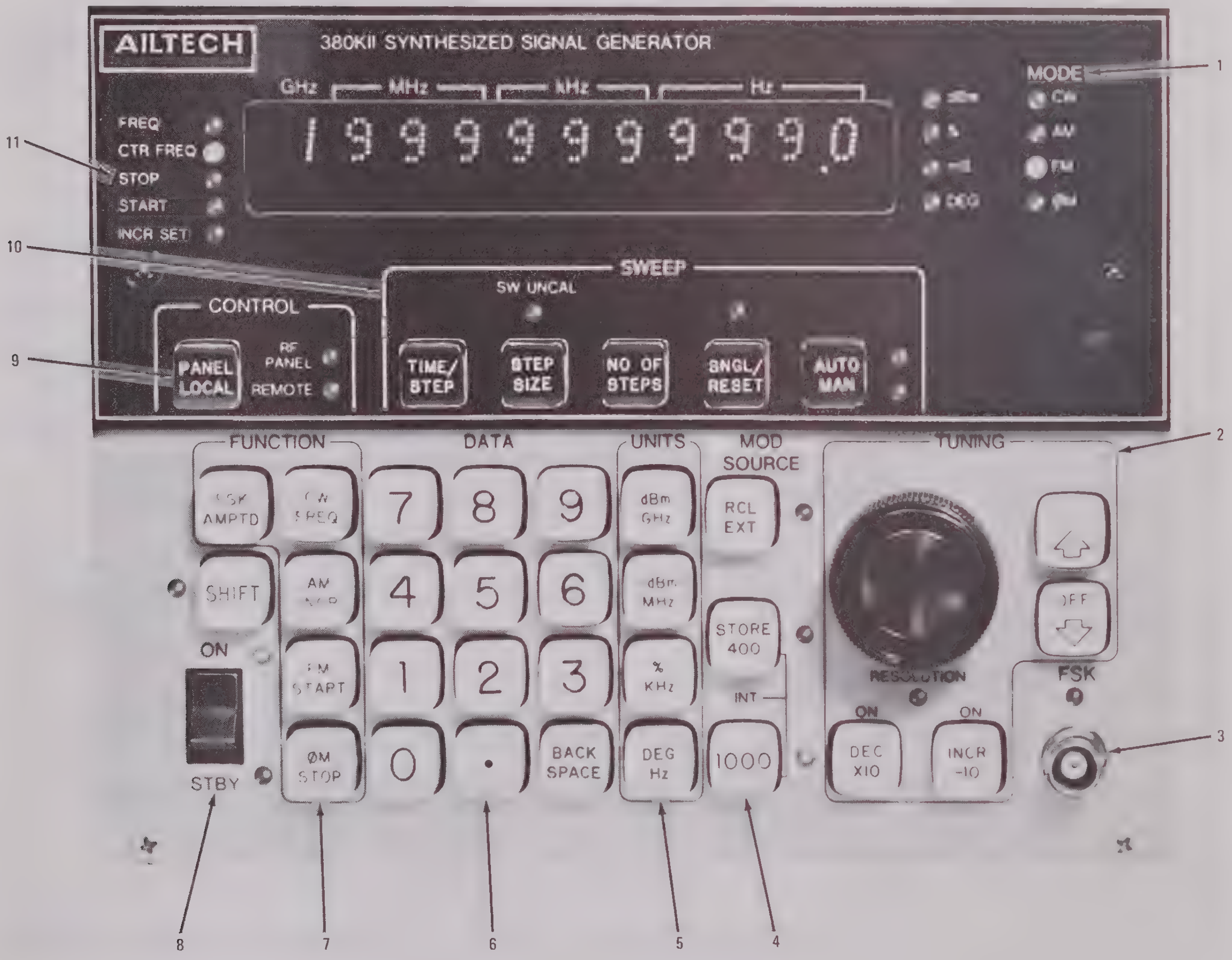


Figure 3-1. Front Panel Controls and Indicators

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS

Figure 3-1 Index No.	Control or Indicator	Function
1	Mode Indicators	Four LED's which provides indication of the type of modulation present.
	CW	Modulation off
	AM	Amplitude Modulation
	FM	Frequency Modulation
	ØM	Phase Modulation
2	Tuning	This section allows any value selectable parameter to be changed.
	Tuning Knob	Stepping controls consist of a rotary control knob and stepping keys. Either control may be used to increment the value of selected functions.
	⇧	Increases the parameter being changed in steps.
	OFF ⇩	Decreases the parameter being changed in steps. When Tuning LED is illuminated, indicates that rotary control is activated. (SHIFT) OFF, turns off the control.
	ON DEC X10	(SHIFT) ON, turns on the control. (SHIFT) INCR, turns on increment function. Increases the stepping resolution by a factor of 10, once for each keystroke.
	ON INCR ÷10	Decreases the stepping resolution by a factor of 10, once for each keystroke.
3	Input connector BNC A1J1	TTL input for FSK data, or external sweep trigger.
4	MOD Source RCL EXT · STORE 400 · 1000	Three keys which select 400 or 1000 Hz internal, or external modulation.
	STORE/RCL	(SHIFT) STORE allows the instrument states to be stored, and, (SHIFT)(RECAL), recalled in registers 1 through 9.
5	Units	Four keys which allow the entry to be terminated and entered.

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS (Cont)

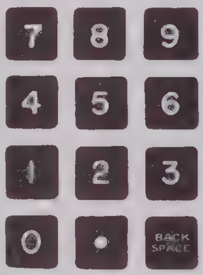
Figure 3-1 Index No.	Control or Indicator	Function
5 (Cont)		Selection of a function automatically selects either Shift or Unshift to properly terminate the function.
	dBm GHz	(SHIFT) dBm, Power related to 1 mw (>1 mw) (Requires 180 series attenuator option) Giga Hertz (X 10^9)
	-dBm MHz	(SHIFT) -dBm Power related to 1 mw (<1 mw) (Requires 180 series attenuator option) Mega Hertz (X 10^6)
	% KHz	(SHIFT) Percent Kilo Hertz (X 10^3)
	DEG Hz	(SHIFT) Degrees for phase modulation Hertz
6	DATA 	Standard keyboard which allows numerical data to be entered. BACK SPACE key clears the last digit or decimal point entered.
7	FUNCTION	Six keys select function to be entered.
	SHIFT	When the associated LED is illuminated the upper nomenclature of a two function key is selected.
	FSK AMPTD	(SHIFT) FSK (Frequency Shift Keying) Illuminates FSK LED and associates the front panel BNC connector with a TTL logic input for FSK Modulation. AMPTD causes the LED display to indicate output level in dBm, and allows a new power in dBm to be entered.
	CW FREQ	(SHIFT) CW turns off all Modulation. FREQ causes the LED display to indicate present frequency, and allows a new frequency to be entered.

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS (Cont)

Figure 3-1 Index No.	Control or Indicator	Function
7 (Cont)	AM INCR	(SHIFT) AM causes the LED display to indicate present AM level, and allows a new percentage of modulation to be entered. INCR causes the LED display to indicate present frequency increment, and allows a new frequency increment or FSK deviation to be entered.
	FM START	(SHIFT) FM causes the LED display to indicate the present frequency deviation and allows a new deviation to be entered. START causes the LED display to indicate the present START frequency and allows a start frequency for a sweep to be entered.
	ØM STOP	(SHIFT) ØM causes the LED display to indicate the present degrees of phase modulation, and allows a new value to be entered. STOP causes the LED display to indicate the present STOP frequency and allows a new value to be entered.
8	ON/STBY switch A1S1	ON/STBY switch selects either STBY mode where dc power is applied to the microprocessor and the crystal oven only or ON mode where the instrument is fully functional. LED indicators indicate the status.
9	CONTROL	This section controls and indicates the following:
	REMOTE	Indicates the control status Local or Remote.
	RF PANEL	Indicates control status of RF and modulation panels, either by keyboard or panel control knobs and selector switches.

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS (Cont)

Figure 3-1 Index No.	Control or Indicator	Function
9 (Cont)		(SHIFT) Panel key allows the RF front panel controls to be enabled or disabled.
		LOCAL allows the instrument to be returned to local control when under GPIB control. (Can be locked out by controller by sending the Local Lockout message.)
10	SWEEP	In conjunction with the START and STOP keys, allows sweep parameters to be entered.
		Each keystroke causes the time/step to change through 1, 10 and 100 ms/step and (O) external.
		Allows a step size to be entered via the front panel keyboard.
		The first keystroke causes the number of steps to be displayed on the LED indicator. Subsequent keystrokes allow selection of 100 or 1000 steps. In this case, a step size will be automatically calculated.
	SW UNCAL	This LED lights when 1000 steps have been exceeded, indicating that the sweep voltage staircase (BNC output rear panel) has limited at a maximum value of +2 volts.
		Depressing while in AUTO sweep instantaneously stops sweep, and returns generator to non-sweep (CW) mode. Subsequent keystrokes initiate a single-sweep.
		(SHIFT) AUTO initializes a repetitive sweep from start to stop at the selected time/step and step size.
		Allows manual sweeping in either direction using the TUNING knob from start to stop at the selected step size.

TABLE 3-1. FRONT PANEL CONTROLS AND INDICATORS (Cont)

Figure 3-1 Index No.	Control or Indicator	Function
11	Display Function	Five LEDs indicate the function being displayed.
	FREQ	The display indicates the instantaneous frequency in Hz.
	CTR FREQ	The display indicates the center frequency of a sweep.
	STOP	The display indicates the stop frequency of a sweep.
	START	The display indicates the start frequency of a sweep.
	INCR SET	The display indicates the stepping frequency increment.
	Display	An eleven digit LED seven segment display which displays the above functions in numerical form.
	Display Units	Provides the numerical indication of the functions. When none of the function LEDs are lit, the units displayed are in Hz.
	dBm	Power in dBm referred to 1 mW (0 dBm).
	%	Percent
	mS	Milliseconds
	DEG	Degrees

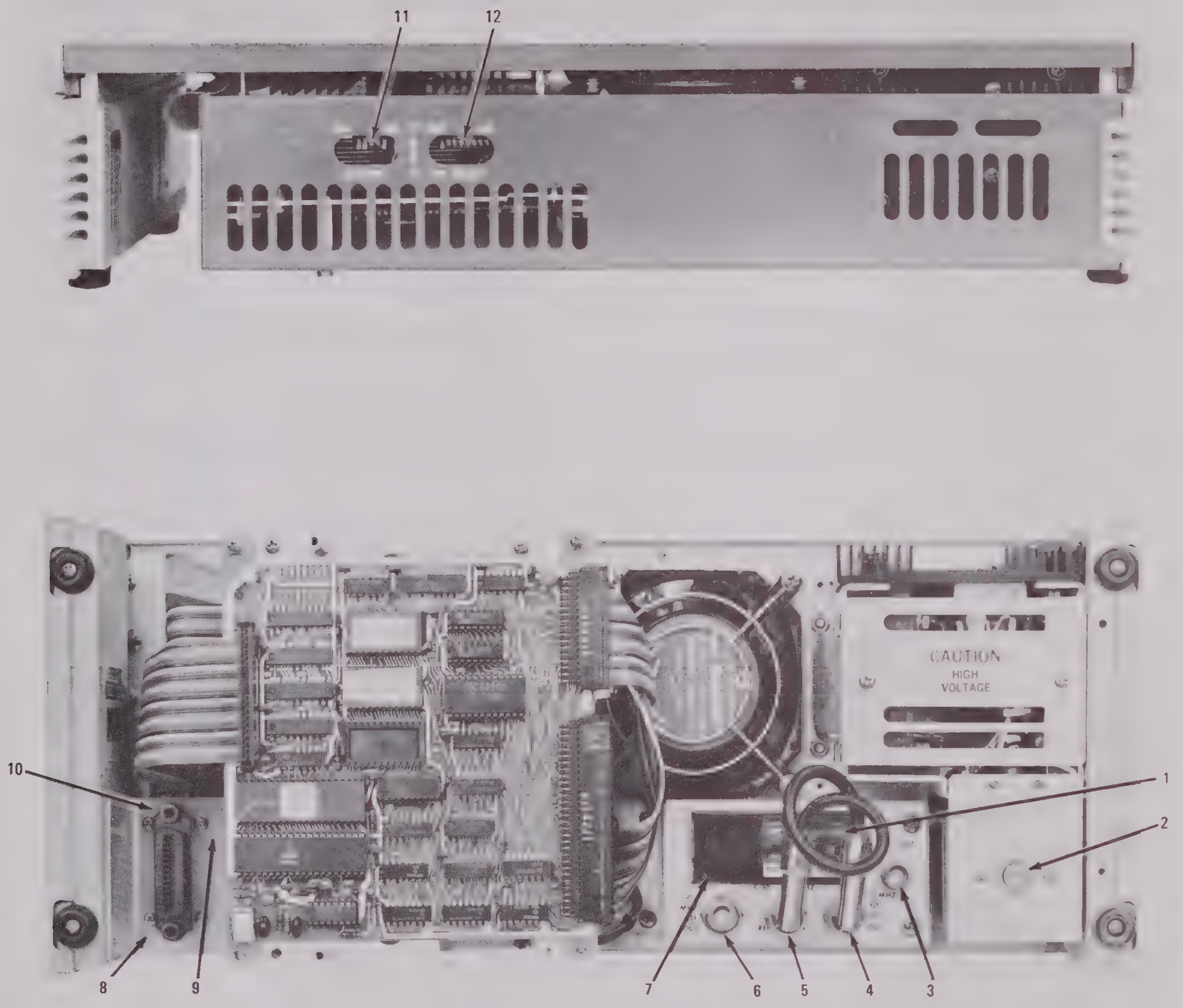


Figure 3-2. Rear Panel Controls and Connectors

TABLE 3-2. REAR PANEL CONTROLS AND CONNECTORS

Figures 3-2 Index No.	Control	Function
1	Line fuse and 115/230V switch	Ac line fuse; 115/230V selectable PC switch that allows selection of primary power.
2	FREQ ADJ	±2 parts in 10^6 frequency adjustments for optional internal standard.
3	SWP OUT	BNC connector provides a 0 to 2V stepped dc ramp voltage proportional to the steps in RF frequency in sweep mode, 1000 steps maximum.
4	10 MHz INT STD OUT	BNC connector for internal frequency standard output. Used only with Options 002 and 003.
5	5/10 MHz REF IN	BNC connector for internal or external frequency standard input to the synthesizer.
6	10 MHZ REF OUT	BNC connector provides the buffered 10 MHz reference signal output.
7	AC Input	Ac line connector, 115/230 volts ±10%, 48-66 Hz. (50 to 400 Hz with Option 004) Plug-in PC card changes ac voltage selected.
8	IEEE 488 Input	Standard IEEE 488 input connector provides the interface with a 488 controller.
9	J5	50 pin connector provides a means for applying frequency control inputs, in parallel BCD. For keyboard control, the latch PC board connector P5 is attached to this input. In the BCD mode, the LED display is inactive. See Rf Section Manual for programming information.
10	J4	36 pin connector provides a means for applying level and modulation control input in parallel BCD. For keyboard control, the MPU PC board connector P4 is attached to this input. See PM3602 Modulator Manual for programming information.
11	MSB LSB "0" ↕ ADDRESS "1"	GPIB address switches. Address are 0 to 30.

TABLE 3-2. REAR PANEL CONTROLS AND CONNECTORS (Cont)

Figure 3-2 Index No.	Control	Function
12	“0” MSB LSB ↕ “1” PPL SELECT	Parallel Poll select switches. Settings are 1 through 8.

3-10. DETAILED OPERATING INSTRUCTIONS

3-11. CONTROLLED FUNCTIONS. All instrument functions are controlled by the keyboard and settings are displayed on an 11 digit LED readout. Annunciators indicate the displayed functions. The keystroke sequence is function, data and units, and proceeds from left to right. When line power is first applied, operation is initialized at 100 MHz, -20 dBm output, CW mode. In the standby mode, keep alive power allows previous settings and stored programs to be held in memory.

3-12. SHIFT KEY.

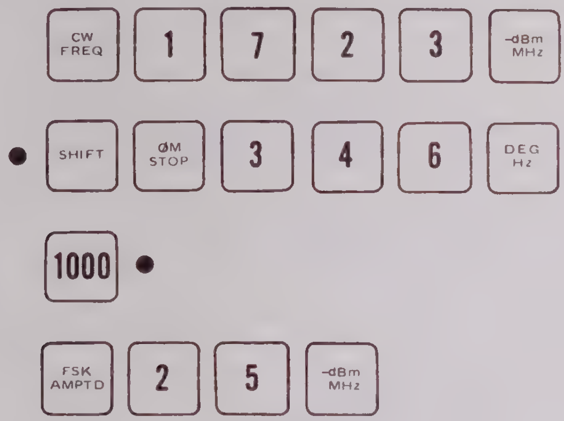
- SHIFT The 380 keyboard uses double function keys. For example, the key CW FREQ has two

functions, the upper function is CW which is used to turn off all forms of modulation (CW carrier), and the lower function, FREQ, is used to allow entry of frequency data. The SHIFT key is used when the upper function of a two function key is to be chosen. The LED associated with the SHIFT key indicates when the SHIFT function is active. The SHIFT function latches automatically when a function is chosen which would otherwise require the SHIFT key to be stroked a second time for UNITS selection; thereby eliminating the need for another SHIFT keystroke per entry. The SHIFT automatically unlatches after the UNITS key is stroked, and the SHIFT LED is extinguished.

3-13. INITIALIZE. This function returns the operation of the synthesizer to 100 MHz — 20 dBm output, CW mode. Stored programs held in any of the nine memory registers are not affected by this function.

- SHIFT RCL EXT 0 •

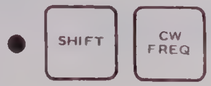
3-14. FREQUENCY, MODULATION AND LEVEL. A setup of 1723 MHz, phase modulated at 346°, at a level of -25 dBm, 1000 Hz internal modulation:



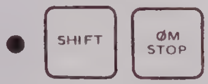
Note

Selection of ØM and AMPTD automatically selects SHIFT function (LED on) and units can be keyed directly without manually shifting. Keying units automatically returns SHIFT to off.

To turn modulation off:



To return to the previous modulation setting:



Note

In these keystrokes, since data and units are not entered, SHIFT LED will remain on. If next function does not require SHIFT, it must be keyed to turn OFF

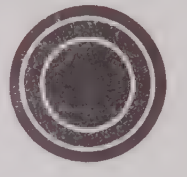
3-15. TUNING/INCREMENTING. Frequency, output level and modulation levels can be incremented using the up/down keys or the tuning knob. Frequency can be incremented in selectable decades or by entering an increment value.

3-16. FREQUENCY INCREMENTING WITHIN DECADES.

DEC ×10 Display indicates a 1 in the decade column to be incremented — change the decade to be incremented by:

DEC ×10 or INCR 10 then CW FREQ and ⇧ or OFF ⇩

To enable the tuning knob: ● SHIFT DEC ×10 then



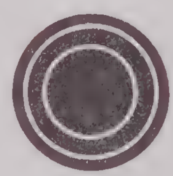
To disable the tuning knob: ● SHIFT OFF ⇩

3-17. FREQUENCY SET INCREMENTING.

To increment in selectable step sizes, e.g., 25 kHz:

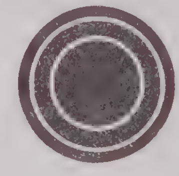
AM INCR 2 5 % KHz ● SHIFT INCR 10 CW FREQ

Then ⇧ or OFF ⇩ or



3-18. AMPLITUDE INCREMENTING IN FIXED 0.5 dB STEPS.

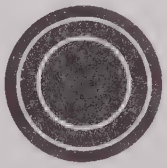
FSK AMPTD DEC ×10 then ⇧ or OFF ⇩ or



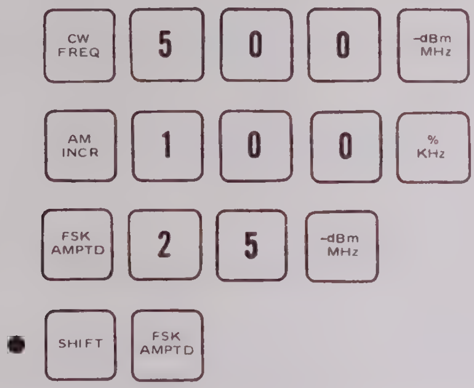
3-19. MODULATION INCREMENTING. Is in 0.5% steps for AM. For FM, increments are 50 Hz steps to 10 kHz, 500 Hz steps from 10 kHz to 100 kHz, 5 kHz steps from 100 kHz to 1 MHz, and 50 kHz steps from 1 MHz to 10 MHz. For phase modulation, increments are 0.5° up to 100° and 2° from 100° to 400°.

● SHIFT FM START then ⇧ or OFF ⇩

or ● SHIFT DEC ×10 and

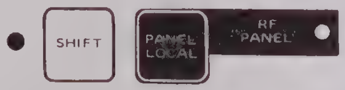


3-20. FREQUENCY SHIFT KEYING (FSK). The 380 can be used to generate FSK modulation at rates to 14,000 bit/sec (7 kHz maximum) e.g., 500 MHz carrier, 100 kHz frequency shift (deviation), –25 dBm output level.



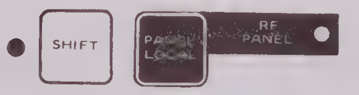
Then input the data stream at TTL levels into the FSK connector on the front panel. A logic 1 is f_c, a 0 is $f_c + f_{incr}$.

3-21. RF PANEL CONTROL. Normally, all modulator and RF panel controls are disabled and control of all functions is through the keyboard. The controls can be enabled allowing conventional operation of the modulation and RF output level:



Then operate panel controls.

To shift control back to the keyboard:

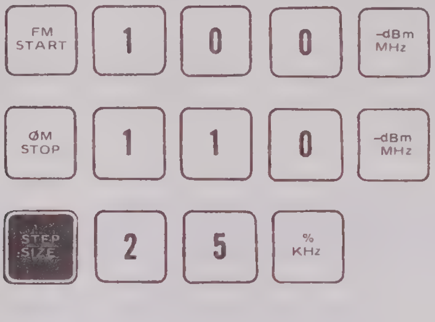


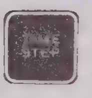
3-22. SYNTHESIZED DIGITAL SWEEP. To sweep the 380, the START and STOP frequencies are first entered. Sweep speed is selected using the TIME/STEP key, which allows a choice of 0, (External) 1, 10 or 100 msec per step. The current TIME/STEP is displayed after pressing the TIME/STEP key. Subsequent pressing of this key changes the TIME/STEP.

1. Next, either the STEP SIZE may be selected and the number of steps is automatically calculated, or alternatively, the number of steps; 100 or 1000, may be selected, and STEP SIZE will be automatically calculated. The SW UNCAL LED indicates when the number of steps is more than 1000, which is the maximum for the SWEEP OUTPUT VOLTAGE.
2. Sweep modes can be selected from a choice of SINGLE, AUTO, or MANUAL. When either the SINGLE or AUTO sweep is in process, the frequency display indicates the center frequency of the sweep. When MANUAL sweep is selected, the frequency display indicates the instantaneous frequency.

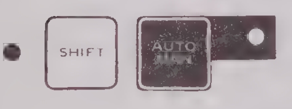
3. To stop the sweep when in AUTO, depress SNGL/RESET. Depressing START or STOP will position output at each end of sweep.
4. In order to enter new data while in AUTO sweep, the sweep must first be stopped by depressing SNGL/RESET.

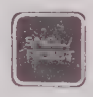
Example 1: Auto Sweep between 100 MHz and 110 MHz in 25 kHz increments at 100 msec/step.

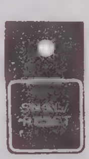




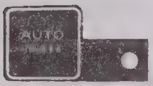
Each time depressed, rolls through 0, (Ext) 1, 10 or 100 msec as indicated on display

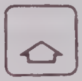
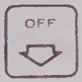


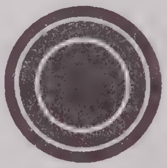
The sweep may be stopped instantaneously by pressing 

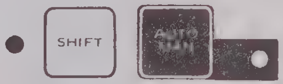
For a Single Sweep 

To sweep in MANUAL:

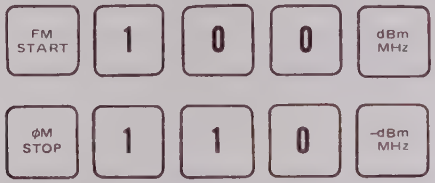


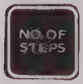
Then  or 

or 

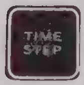
To return to Auto Sweep: 

Example 2: Auto Sweep between 100 MHz and 110 MHz in 100 or 1000 steps using an external clock.

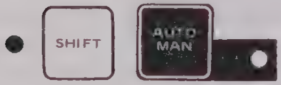




Changes selection from either 100 or 1000 steps each time pressed

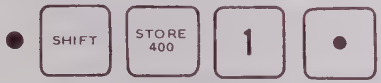


Choose 0 (Ext) from the 0, 1, 10, 100 msec menu, then connect TTL clock signal to FSK connector, maximum clock rate is 2 kHz. (500μs/step)

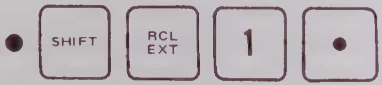


3-23. STORE/RECALL. Up to nine front panel set-ups can be stored in memory. Storage registers are one through nine. Sweep set-up can also be stored, however sweep modes are not stored, and must be selected after recall. First, enter the desired parameters, then:

To Store



To Recall



3-24. IEEE 488 PROGRAMMING

3-25. REMOTE GPIB OPERATION. The 380 can be operated through the General Purpose Interface Bus (GPIB). Bus compatibility, programming and data format are described in the following paragraphs. For more information about GPIB refer to IEEE Standard 488-1978. All front panel functions (except for that of the LINE switch), are programmable through the GPIB. The complete bus compatibility of the 380 (as defined by IEEE Standard 488-1978) is described at the end of Table 3-3.

3-26. GPIB MESSAGES. The programming capability of the 380 is further described by the eleven GPIB messages in Table 3-3. Foremost among these messages is the data message. Data messages contain the controller's talk address, the generator's listen address, a string of program codes (not exceeding 22 characters in length), and an End-of-String message (EOS). The string follows the same protocol as key strokes at the front panel.

3-27. LOCAL-TO-REMOTE TRANSITION. The 380 communicates on the bus in the remote mode. In remote, its front panel controls are disabled (except for the LINE switch, and LOCAL key). The 380 will respond to the following messages: Data, Clear, Remote, Local, Local Lockout, Clear Lockout/Set Local and Abort. When addressed to talk, the 380 will automatically stop listening and send the status byte message, when being serial polled.

3-28. The 380 is enabled for remote operation upon receipt of the remote message. However, it remains in local mode (that is, the front panel is the control) until the 380 is first addressed to listen. Thereafter, it remains in remote until the front panel LOCAL key is pressed or it receives an appropriate message from the controller. The 380 output signal remains unchanged and all preselected front panel functions remain unchanged with the local-to-remote transition.

3-29. **REMOTE-TO-LOCAL TRANSITION.** The 380 returns to local control upon receipt of the Local or Clear Lockout/Set Local message. It can also be set to local mode by pressing the front panel LOCAL key (assuming that local lockout is not in effect). The 380 output signal remains unchanged and all preselected functions remain unchanged with the remote-to-local transition.

TABLE 3-3. MESSAGE REFERENCE TABLE

GPIB Messages	Response	Related Commands and Controls	Interface Functions
Data	All front panel functions, and remote only functions are programmable. The 380 can send Status Byte information.		T6 L4 AH1 SH1
Clear	Sets output to 100 MHz, -20 dBm with modulation and sweep off. Responds equally to DCL and SDC bus commands.	DCL SDC	DC1
Remote	The 380 remote mode is enabled when the REN bus line is true. However, it remains in local (i.e., the front panel enabled) until it is addressed to listen the first time. The output signal is unchanged. The front panel REMOTE indicator turns on for remote-enabled.	REN	RL1
Local	The 380 returns to front panel control. The output signal is unchanged. Responds equally to the GTL bus command and the front panel LOCAL key.	GTL	RL1
Local Lockout	LOCAL key is disabled. Only the controller can return the 380 to local.	LLO	RL1
Clear Lockout/ Set Local	The 380 returns to local when the REN bus line goes false.	REN	RL1

TABLE 3-3. MESSAGE REFERENCE TABLE (Cont)

GPIB Messages	Response	Related Commands and Controls	Interface Functions
Pass Control/ Take Control	The 380 has no controller capability		C
Require Service	The 380 sets the SRQ bus line true if one of the following conditions exist and it has been enabled to send the message for that condition. End of Single Sweep Power Restart.		SR1
Status Byte	The 380 responds to a Serial Poll Enable (SPE) bus command by sending an 8-bit byte. Bit 6 (RSV bit) is true if generator had sent the Require Service Message.	SPE SPD	T6
Status Bit (PPR Message)	The 380 ends the Status Bit message (PPR message), when parallel polled by the controller, by setting ATN and IDY true.	ATN, IDY	PP2
Abort	The 380 stops talking or listening.	IFC	T6 L4

*Commands control lines and interface functions are defined in IEEE Standard 488-1978. Knowledge of these might not be necessary if your controller's manual describes programming in terms of the eleven GPIB messages shown in the left column.

Complete GPIB capability as defined in the IEEE Standard 488-1978 is: SH1, AH1, T6, TEO, L4, LEO, SR1, RL1, PP2, DC1, DTO, CO.

3-30. LOCAL LOCKOUT. When a data transmission is interrupted, which can happen by returning the 380 to local with the LOCAL key, the data could be lost. This would leave the 380 in an unknown state. To prevent this, a local lockout is recommended. Local lockout disables the LOCAL key and allows return-to-local only under program control.

3-31. ADDRESSING THE 380. Set decades 1 to 5 of ADDRESS SWITCH (top of rear cover) to 1 or 0, in accordance with the binary digit corresponding to the selected decimal address between 0 and 30.

TABLE 3-4. IEEE NOTATIONS

NOTATION CONVENTIONS		
<>		Items enclosed within angular brackets are considered to be elements of the language being defined.
:: =		"Is defined as" A :: = <B C> indicates that A can be replaced by the series of elements B C in any statement which A occurs.
|		"or" indicates a choice of exactly one element from list (e.g., A|B indicated A or B but not both.
DEFINITIONS		
<listen>		:: = Controller addresses analyzer to listen
<value>		:: = 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ASCII
<value 2>		:: = Packed BCD
DATA ENTRY TO SYNTHESIZER		
<entry>		:: = <value> <terminator>
<entry 2>		:: = <value 2> <terminator>
<terminator>		:: = <units code> <delimiter>
<terminator 2>		:: = <dummy characters> <delimiter>
<dummy character>		:: = <any ASCII characters except linefeed>
<terminator 3>		:: = < • > <delimiter>
<delimiter>		:: = <LF> | <EOI>
<LF>		:: = OA (ASCII Line Feed)
<EOI>		:: = End or identify — issued on last character with ATN not active and EOI active.
<Units Code>		:: = +D | -D | PC | DG | HZ | KZ | MZ | GZ
Units of Power:	+D	:: = < dBm>
	-D	:: = <-dBm>
Units of Phase:	DG	:: = <Degrees>
Units of Percentage	PC	:: = <Percentage %>
Units of Frequency:	HZ	:: = <Hertz>
	KZ	:: = <Kilohertz>
	MZ	:: = <Megahertz>
	GZ	:: = <Gigahertz>

TABLE 3-5. PROGRAMMING CODES

Code	Syntax	Function
AM	<Listen> AM <Entry>	Amplitude Modulation
AP	<Listen> AP <Entry>	Amplitude
AS	<Listen> AS <Entry>	Auto Sweep
+D	<Units Code>	dBm
-D	<Units Code>	-dBm
DG	<Units Code>	Degree
FA	<Listen> FA <Entry>	Start Frequency
FB	<Listen> FB <Entry>	Stop Frequency
FD	<Listen> FD <Delimiter>	Frequency Shift Key Disable
FE	<Listen> FE <Delimiter>	Frequency Shift Key Enable
FM	<Listen> FM <Entry>	Frequency Modulation
FR	<Listen> FR <Entry>	Frequency
GZ	<Units Code>	Gigahertz
HZ	<Units Code>	Hertz
IS	<Listen> IS <Entry>	Increment Set
KZ	<Units Code>	Kilohertz
L	<Listen> L <Entry 2>	Fast Learn
M0	<Listen> M0 <Delimiter>	Continuous Wave
M1	<Listen> M1 <Delimiter>	Internal 400 Hz
M2	<Listen> M2 <Delimiter>	Internal 1 kHz
M3	<Listen> M3 <Delimiter>	External
MZ	<Units Code> <Delimiter>	Megahertz
N1	<Listen> N 1 | 2 <Delimiter>	Number of steps 1 — selects 10 2 — selects 100
PC	<Units Code>	Percent
PM	<Listen> PM <Entry>	Phase Modulation
RC	<Listen> RC 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 <Terminator 3>	Recall State
SD	<Listen> SD <Delimiter>	Step Down
SS	<Listen> SS <Delimiter>	Single Sweep
ST	<Listen> ST 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 <Terminator 3>	Save State
SU	<Listen> SU <Delimiter>	Step Up
SZ	<Listen> SZ <Entry>	Step Size
T	<Listen> T | 0 | 1 | 2 | 3 <Delimiter>	Time/Step 0 — External 1 — 1 msec 2 — 10 msec 3 — 100 msec

3-32. PROGRAMMING EXAMPLES. The following examples indicate the 380 programming using either the Tektronix 4051, the HP 9825, or the HP 85. The GPIB address of the 380 in the following examples is set at 25.

INITIALIZE

Synthesizer initializes to 100 MHz, –20 dBm, CW mode.

TEK 4051	HP 9825	HP 85
PRINT @25,32: “RC0.”	wrt 725, “RC0.”	OUTPUT725; “RC0.”

FREQUENCY MODULATION AND LEVEL

A setup of 172 MHz, phase modulated at 46°, at a level of –25 dBm, 1000 Hz internal modulation.

TEK 4051	HP 9825	HP 85
PRINT @25,32: “FR172MZ”	wrt 725, “FR172MZ”	OUTPUT725; “FR172MZ”
PRINT @25,32: “PM46DG”	wrt 725, “PM46DG”	OUTPUT725; “PM46DG”
PRINT @25,32: “M2”	wrt 725, “M2”	OUTPUT725; “M2”
PRINT @25,32: “AP25-D”	wrt 725, “AP25-D”	OUTPUT725; “AP25-D”

The above Data Messages can be sent in a series string not exceeding 22 characters.
e.g., “FR172MZPM46DGM2AP25-D”

INCREMENTING

Incrementing (Step Up/Step Down) Frequency in 25 kHz steps.

TEK 4051	HP 9825	HP 85
PRINT @25,32: “IS25KZ”	wrt 725, “IS25KZ”	OUTPUT725; “IS25KZ”
PRINT @25,32: “FR SU”	wrt 725, “FR SU”	OUTPUT725: “FRSU”
PRINT @25,32: “SD”	wrt 725, “SD”	OUTPUT725; “SD”

FREQUENCY SHIFT KEYING

Program a 500 MHz carrier, 100 kHz frequency shift at –25 dBm.

TEK 4051	HP 9825	HP 85
PRINT @25,32: “FR500MZ”	wrt 725, “FR500MZ”	OUTPUT725; “FR500MZ”
PRINT @25.32: “M0”	wrt 725, “M0”	OUTPUT725; “M0”
PRINT @25,32: “IS100KZ”	wrt 725, “IS100KZ”	OUTPUT725; “IS100KZ”
PRINT @25,32: “FE”	wrt 725, “FE”	OUTPUT725; “FE”

Next connect the keying waveform to the front panel BNC connector marked FSK. If keying is desired over the GPIB, use the Step Up/Step Down function, instead of a keying generator.

PRINT @25,32: “FD”	wrt 725, “FD”	OUTPUT725; “FD”
PRINT @25,32: “FR SU”	wrt 725, “FR SU”	OUTPUT725; “FRSU”
PRINT @25,32: “SD”	wrt 725, “SD”	OUTPUT725; “SD”

SYNTHESIZED DIGITAL SWEEP

Auto Sweep between 100 MHz and 110 MHz in 25 kHz increments at 100 msec/step.

TEK 4051	HP 9825	HP 85
PRINT @25,32: "FA100MZ"	wrt 725, "FA100MZ"	OUTPUT725; "FA100MZ"
PRINT @25,32: "FB110MZ"	wrt 725, "FB110MZ"	OUTPUT725; "FB110MZ"
PRINT @25,32: "SZ25KZ"	wrt 725, "SZ25KZ"	OUTPUT725; "SZ25KZ"
PRINT @25,32: "T3"	wrt 725, "T3"	OUTPUT725; "T3"
PRINT @25,32: "AS"	wrt 725, "AS"	OUTPUT725; "AS"

To STOP the sweep:

TEK 4051	HP 9825	HP 85
PRINT @25,32: "SS"	wrt 725, "SS"	OUTPUT725; "SS"

To SINGLE SWEEP, again repeat message:

PRINT @25,32: "SS"	wrt 725, "SS"	OUTPUT725; "SS"

STORE/RECALL

To store the above sweep parameters in register 1:

TEK 4051	HP 9825	HP 85
PRINT @25,32: "ST1."	wrt 725, "ST1."	OUTPUT725; "ST1."

To recall the sweep:

TEK 4051	HP 9825	HP 85
PRINT @25,32: "RC1.AS"	wrt 725, "RC1.AS"	OUTPUT725; "RC1.AS"

Note sweep mode is non-storable and must be selected each time sweep is recalled.

LOCAL LOCKOUT

Disables local key. Only the controller can return the 380 to local.

TEK 4051	HP 9825	HP 85
WBYTE @57,17:	II07	LOCAL LOCKOUT 7

CLEAR LOCKOUT

Return 380 to local.

TEK 4051	HP 9825	HP 85
WBYTE @57,11:	1c17/rem 7	LOCAL 7

SENDING THE REQUIRE SERVICE MESSAGE

The 380 sends a Require Service message if one of the following conditions exist:

- End of Sweep in a Single Sweep mode.
- Power Up: When 380 is manually switched from STBY to ON, (only if the 380 has been and is still under bus control).

The Require Service message is sent by setting the Service Request (SRQ) bus line true, and it is cleared after a serial poll has been executed by the controller.

3-33. **SENDING THE STATUS BYTE MESSAGE.** After receiving a Serial Poll Enable command (SPE) and when addressed to talk, the 380 sends a Status BYTE message. Status bit 1 is set true at End of Sweep in a Single Sweep mode. Status bit 2 is set true at Power Up. The Status bits are cleared after the 380 has been serial polled.

SYSTEM BYTE

BIT	8	7	6	5	4	3	2	1
Condition	0	Request Service	0	0	0	3	Power UP	End of Sweep

3-34. **PARALLEL POLL INTERFACE FUNCTION.** When several devices on the bus are capable of requesting service, the controller does not have to poll each device serially to determine which one it is. Another operation called a parallel poll is capable of polling up to eight devices at one time. Each device is assigned to one of the eight data lines on which to respond when a parallel poll is conducted. When the controller senses SRQ, it conducts a parallel poll by setting both ATN and EOI true at the same time. (Note: In the data mode the EOI line has the meaning of end-of-message. In the ATN true mode, it has the meaning of identify, in the sense of a parallel poll). All devices currently requesting service will then respond on their assigned data line. And by checking the bits in this poll byte, the controller can immediately determine which devices require service, without serially polling each one. If the device requesting service has more than one possible reason for asserting SRQ, the controller may also conduct a serial poll on that one device and its status byte could contain more detailed information about why SRQ was asserted.

3-35. The parallel poll interface function provides the 380 with the capability to present one bit of status to the controller without previously being addressed to talk.

3-36. The signal lines DI01 through DI08 are used to convey the device status bits during the parallel poll. This allows up to eight devices with a one-line-per-device assignment, although any number of devices can be handled through sharing DI0 lines.

3-37. The 380 employs the PP2 subset of the PP interface function. This subset omits the capability of being configured by the controller. Therefore, the PPR (parallel poll response) message and message sense (S) to be used during a parallel poll must be set on the PPL select switches numbered 1 through 8, located on the top rear cover.

3-38. A “1” is set when the switches are in the open position. The following Table 3-6 will aid in setting these switches. The PPR message specified by the switch settings will be set true during a parallel poll only when the 380 is sending the Require Service Message.

TABLE 3-6. PARALLEL POLL

PPR Message Specified	S = “1”	S = “0”
PPR1	Open only S1	Close only S1
PPR2	Open only S2	Close only S2
PPR3	Open only S3	Close only S3
PPR4	Open only S4	Close only S4
PPR5	Open only S5	Close only S5
PPR6	Open only S6	Close only S6
PPR7	Open only S7	Close only S7
PPR8	Open only S8	Close only S8

3-39. **FAST LEARN FUNCTION.** The Fast Learn Function is used when it is desired to load a frequency into the 380 in approximately 100 μs, over the interface bus. Since the frequency switching time for the 380 is less than 20 μs, total switching time using the Fast Learn Function is less than 104 μs, when using a controller capable of transferring data at a rate of 125k bytes. To use the Fast Learn Function, the 380 must first be addressed to listen and then the following syntax is used: (See examples on page 3-22.)

$$L\ \underset{\text{Frequency 1}}{\underline{F_{11}F_{12}F_{13}F_{14}F_{15}F_{16}S_{17}}}\qquad \underset{\text{Frequency 2}}{\underline{F_{21}F_{22}F_{23}F_{24}F_{25}F_{26}S_{27}}}\ \cdots\cdots$$

3-40. The ASCII character L must always precede the fast learn string. The next six bytes represent frequency coded as double packed BCD. Coding information is as follows Table 3-7.

TABLE 3-7. FAST LEARN CODING

DATA BYTE	DIO DATA BITS	
	DIO8-DIO5	DIO4-DIO1
Fx1	BCD 0	BCD 1 GHz
Fx2	BCD 100 MHz	BCD 10 MHz
Fx3	BCD 1 MHz	BCD 100 KHz
Fx4	BCD 10 KHz	BCD 1 KHz
Fx5	BCD 100 Hz	BCD 10 Hz
Fx6	BCD 1.0 Hz	BCD 0.1 Hz

FAST LEARN MODE

Using Single String Format, program the 380 for 100 MHz, 110 MHz and 120 MHz. (For coding refer to Tables 3-7 and 3-8.)

TEK 4051

ADDRESS OF 380
ASCII "L"
PACKED BCD AS PER TABLE 3-7 REPRESENTING 100 MHZ
LINE FEED TERMINATOR

```
WBYTE @57:  76,  0,16,0,0,0,0,  10 ———→ 100 MHz
WBYTE @57:  76,  0,17,0,0,0,0,  10 ———→ 110 MHz
WBYTE @57:  76,  0,18,0,0,0,0,  10 ———→ 120 MHz
```

HP-9825

ADDRESS OF 380
ASCII "L"
PACKED BCD AS PER TABLE 3-7 REPRESENTING 100 MHZ
LINE FEED

```
wtb 725,  76,  0,16,0,0,0,0,  10
wtb 725,  76,  0,17,0,0,0,0,  10
wtb 725,  76,  0,18,0,0,0,0,  10
```

HP-85

SELECT CODE 380
ASCII "L"
PACKED BCD AS PER TABLE 3-7 REPRESENTING 100 MHZ
LINE FEED

```
SEND 7;  LISTEN 25 DATA 76,  0,16,0,0,0,0,  10
SEND 7;  LISTEN 25 DATA 76,  0,17,0,0,0,0,  10
SEND 7;  LISTEN 25 DATA 76,  0,18,0,0,0,0,  10
```

Using Blocked String Format, program the 380 for 100 MHz and then 110 MHz. In this format only the last frequency programmed will be displayed on the 380 Frequency Synthesizer.

TEK 4051

100 MHZ
CARRIAGE RETURN
110 MHZ
LINE FEED

```
WBYTE @57:  76,  0,16,0,0,0,0,  13,  0,17,0,0,0,0,  10
```

HP-9825

100 MHZ
110 MHZ

```
wtb 725,  76,  0,16,0,0,0,0,  13,  0,17,0,0,0,0,  10
```

HP-85

100 MHZ
110 MHZ

```
SEND 7:  LISTEN 25 DATA 76,  0,16,0,0,0,0,  13,  0,17,0,0,0,0,10
```

Note: 1 For primary address's when utilizing the TEK 4051, consult the 4051 graphic systems manual. For example primary address 57 is used for peripheral address 25.

3-41. Leading zeroes must not be suppressed and must be included with the data. Spaces and decimal points must not appear in the string.

3-42. The function of the S_{x7} byte is to strobe the frequency bits into the RF plug-in. The value of the S_{x7} byte depends upon where it appears in the string. If it is not the last character in the string, it may be a <CR> or an L. If it is the last character in the string, it must be a <LF> or <CR> with EOI.

3-43. When the S_{x7} byte is a <LF> or <CR> with EOI, it will cause an MPU interrupt. The MPU then displays the last frequency on the LED display. The <LF> or <CR> with EOI terminates the fast learn mode. To re-enter this mode, the controller needs to output an L.

TABLE 3-8. FAST LEARN MODE PACKED BCD CONVERSION TABLE DECIMAL TO BCD BYTE

DECIMAL	BCD BYTE
0 to 9	0 to 9
10 to 19	16 to 25
20 to 29	32 to 41
30 to 39	48 to 57
40 to 49	64 to 73
50 to 59	80 to 89
60 to 69	96 to 105
70 to 79	112 to 121
80 to 89	128 to 137
90 to 99	144 to 153

Examples:

Frequency	Packed BCD
51.4853921 MHz	0, 5, 20, 133, 57, 33
1721.5694870 MHz	1, 114, 21, 105, 72, 112

3-44. BCD PARALLEL PROGRAMMING.

3-45. The 380 can be programmed directly in a parallel BCD format, when it is desired to obtain the fast switching performance of direct synthesis. The logic is TTL positive true, and is accessed by removing connectors J4 and J5 at the rear of the RF Section. This mode of operation bypasses the keyboard and LED display. Local operation can only be obtained by re-connecting the cables from the rear controller section. Frequency programming and remote mode operation are described in detail in the RF Section manuals. Output level programming is described in Appendix A of the RF Section manuals and modulation programming is described in the PM3602 Modulator manual.

CHAPTER 4

PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. This chapter contains the performance tests necessary to verify that the instrument is operating within its prescribed performance limits. Refer to Chapter 5 for System Calibration/Adjustments and Chapter 6 for Maintenance, if required.

4-3. The following tests and their paragraph numbers summarizes the tests to be performed to ensure that the AILTECH 380 Synthesized Signal Generator meets these specifications.

Title	Paragraph
Frequency Accuracy	4-6
Spectral Purity	4-7
Harmonics and Subharmonics	4-8
Spurious Responses	4-9
Signal-To-Phase Noise Ratio	4-10
Output Level Accuracy and Leveling	4-11
AM Modulation	4-12
FM Modulation	4-13
Phase Modulation	4-14

4-4. REQUIRED TEST EQUIPMENT

4-5. Table 4-1 summarizes the required test equipment to enable a technician to complete the performance tests. All applicable test equipment must bear evidence of current calibration.

TABLE 4-1. TEST EQUIPMENT REQUIRED

Equipment Name	Recommended Model
Counter	Systron Donner 6244A
Function Generator	Wavetek 180
Modulation Meter	Booton 82AD
Noise Analyzer	FEL 800B
Power Meter	Booton 42
Spectrum Analyzer	AILTECH 757
Variable Attenuator	HP 394
Variable Attenuator	HP 394A
Voltmeter RMS	HP 8405A
Wave Analyzer	HP 3590
X-Y Recorder	Jerrold AV-5

4-6. **FREQUENCY ACCURACY.** This test is divided into two frequency areas. The first test covers the keyboard frequency and the second covers the remote frequency.

Test Equipment Required

Counter	Systron Donner 6244A
÷ 10 Prescaler	

1. Connect the test equipment as shown in Figure 4-1.

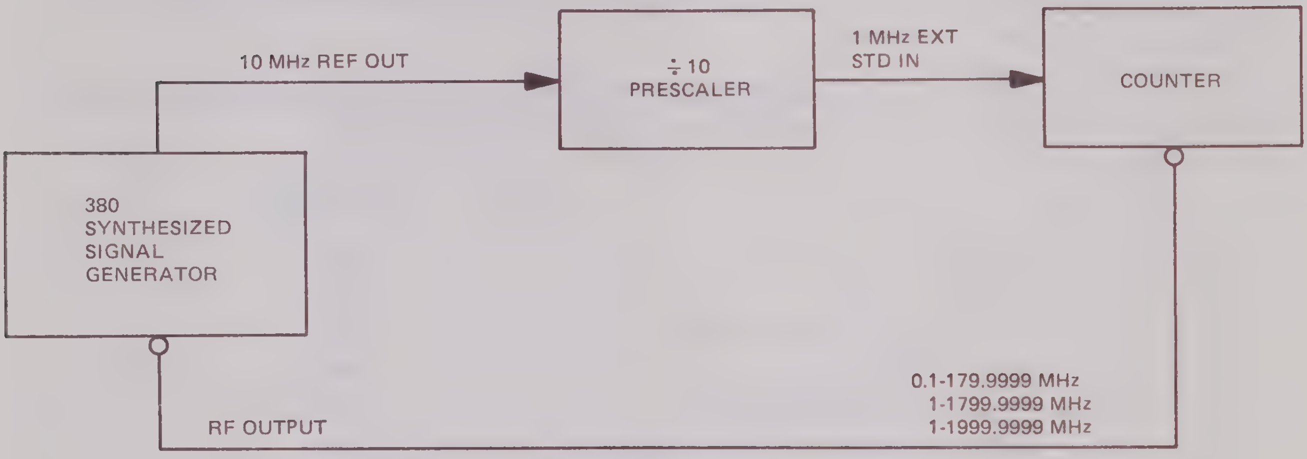


Figure 4-1. Frequency Accuracy Test Setup

2. Set the following frequencies into the LED display using the 380 front panel keyboard.
3. Verify that output frequencies from the 380 are correct on the counter.
4. Record the output frequency readings from the counter in the column under the keyboard heading.

180 MHz Plug-In

	Keyboard	Remote
.5000000 MHz		
1.1111110 MHz		
6.2222220 MHz		
7.3333330 MHz		
9.4444440 MHz		
15.5555500 MHz		
26.6666660 MHz		
37.7777770 MHz		
48.8888880 MHz		
59.9999990 MHz		

180 MHz Plug-In (Cont)

	Keyboard	Remote
61.9000000 MHz	______	______
95.5555550 MHz	______	______
117.3333330 MHz	______	______
126.2222200 MHz	______	______
135.1111110 MHz	______	______
144.0000000 MHz	______	______
159.9999990 MHz	______	______
169.9999990 MHz	______	______
179.9999990 MHz	______	______

1800 and 2000 MHz Plug-Ins

	Keyboard	Remote
5.0000000 MHz	______	______
11.1111100 MHz	______	______
62.2222200 MHz	______	______
73.3333300 MHz	______	______
94.4444400 MHz	______	______
155.5555500 MHz	______	______
266.6666600 MHz	______	______
377.7777700 MHz	______	______
488.8888800 MHz	______	______
599.9999900 MHz	______	______
619.0000000 MHz	______	______
955.5555500 MHz	______	______
1173.3333300 MHz	______	______
1262.2222200 MHz	______	______
1351.1111100 MHz	______	______
1440.0000000 MHz	______	______
1599.9999900 MHz	______	______
1699.9999900 MHz	______	______
1799.9999900 MHz	______	______
1899.9999900 MHz	______	______
1999.9999900 MHz	______	______

5. Connect a bus controller to the GPIB connector J2 on the 380 rear panel.
6. Using the same test setup as in Figure 4-1, program the same frequencies as in Step 4 and check that the frequency outputs are correct on the counter.

7. Record the output frequency readings from the counter in the column under the Remote heading.

4-7. SPECTRAL PURITY

This test is provided in three phases, proceed as follows:

4-8. HARMONICS AND SUBHARMONICS.

Test Equipment Required

Attenuator	HP 394A
Noise Analyzer	FEL 800B
RMS Voltmeter	HP 8405A
Spectrum Analyzer	AILTECH 757
Wave Analyzer	HP 3590
X-Y Recorder	Jerrold AV-5

1. Connect a 757 Spectrum Analyzer to the RF OUTPUT connector on the front panel of the RF Section.
2. Set the spectrum analyzer for 40 dB RF attenuation and 0 dB IF attenuator.
3. Set scan width control for 200 MHz per division.
4. Using keyboard entry, set output level to +5 dBm, CW operation.
5. Set the 380 to sweep from 1 to 179.9 MHz (180 MHz RF Section), 1 to 1799.9 MHz (1800 MHz RF Section) or 1 to 1999.9 MHz (2000 MHz RF Section) in 10 MHz steps at 100 msec/step.
6. Observe the harmonics and subharmonics of the output signal of the 380 on the spectrum analyzer.

RF Section	.01 — 180 MHz	1 — 1800 MHz	1 — 2000 MHz
Harmonics	< -30 dBc 1.0 to 180 MHz	< -20 dBc, CF > 3 MHz < -15 dBc, CF < 3 MHz	< -20 dBc, CF > 3 MHz < -15 dBc, CF > 3 MHz
Subharmonics	None	< 900 MHz, None > 900 MHz < -20 dBc	< 1000 MHz, None > 1000 MHz, < 20 dBc

4-9. SPURIOUS RESPONSES.

Test Equipment Required

Spectrum Analyzer	AILTECH 757

1. Set an AILTECH 757 Spectrum Analyzer to 30 MHz/cm, and 10 dB/cm.
2. Connect the 380 to the analyzer input and set a level until the signal is at the top of display.

CAUTION

Be sure that the spectrum analyzer is not being overdriven which will cause false responses.

3. For the 180 MHz RF Section, carefully search through the frequency range 60 to 179.99 MHz, for any non-harmonic responses. The specification is -95 dBm.
4. For the 1800 MHz RF Section, carefully search through the frequency range 900 to 1799.99 MHz. The specification is -74 dBm.
5. For the 2000 MHz RF Section, carefully search the frequency range 1000 to 1999.99 MHz. The specification is -74 dBm.

4-10. SIGNAL-TO-PHASE NOISE RATIO.

Test Equipment Required

Noise Analyzer	FEL 800B
RMS Voltmeter	HP 8405A
Variable Attenuator	HP 394
Wave Analyzer	HP 3590
X-Y Recorder	Jerrold AV-5

1. Phase noise is measured at the frequencies indicated using the noise test setup as shown in Figure 4-2.

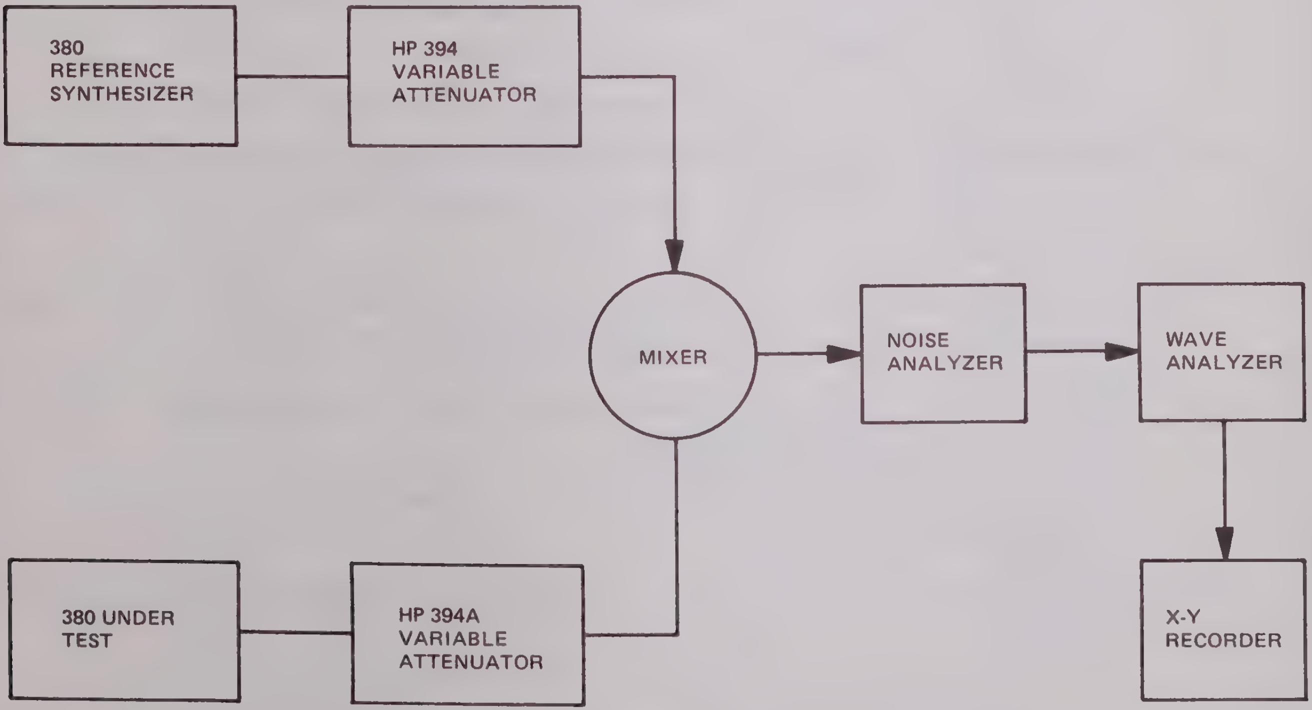

380 REFERENCE SYNTHESIZER
HP 394 VARIABLE ATTENUATOR
MIXER
NOISE ANALYZER
WAVE ANALYZER
380 UNDER TEST
HP 394A VARIABLE ATTENUATOR
X-Y RECORDER

Figure 4-2. Phase Noise Test Setup

2. The X-Y recorder is set up according to procedures in the HP 3590 handbook for a vertical scale of 20 dB/inch.

3. Set wave analyzer controls as follows:

Maximum Input Voltage	0.3V
Absolute/Relative	Absolute
Meter	Normal
Mode	BFO
Range	Auto
BW Response	Slow
Bandwidth	10 Hz
Frequency Range	64 kHz
Sweep	RESET and ON
Sweep Rate	1 Hz/sec
Frequency	10 kHz

4. Connect the BFO output to the step attenuator and connect the output of the attenuator to an RMS voltmeter. This is the CAL SIGNAL. Adjust the attenuator for a 1 mV output.

5. Connect the CAL SIGNAL to the wave analyzer input. Turn X-Y recorder On, Servo On, Pen Up, Chart on Hold. Adjust Y zero to locate pen indicator at the -93 dBc line.

6. Set noise analyzer controls as follows:

Loop BW	200 Hz
Video BW	One step clockwise pass 300 Hz
Lock Disable Switch	Lock

7. Set the 380 under test to any agreed upon frequency, i.e., 1970 MHz, at a level of 0 dBm.

8. Set the reference 380 to a frequency of 27.365 MHz higher or lower than the test frequency, at a power level of 0 dBm. Using the tuning knob, adjust the frequency in 100 Hz increments, for a good lock.

9. Adjust the variable attenuators for the lowest reading on the peak PHASE NOISE meter while maintaining adequate signal strength, as indicated on the SIG STR meter.

10. Connect the PM OUT connector of the phase noise analyzer to the RMS voltmeter. Adjust the CAL control for a reading of 7.07 Vrms.

11. Set the LOCK/DISABLE switch to LOCK position. If phase lock is not achieved, slightly readjust 380 frequency.

12. Connect the PM OUT connector of the phase noise analyzer to the input connector on the wave analyzer.

13. Set the wave analyzer frequency to 1 kHz. Move top recorder pin down to record noise level. If both 380's have the same noise characteristic (reference would have to be verified) the actual noise of the unit under test is 3 dB lower than the measurement.

14. Repeat the measurement at 10 kHz and 100 kHz. If a continuous plot is desired, use 5 cycle semi log graph paper. Use the 10 Hz wave analyzer bandwidth up to 200 Hz offset, 100 Hz bandwidth from 200 to 2000 Hz, and 1 kHz bandwidth above 2 kHz offset. If the analyzer MAX input switch is rotated one step CW each time the bandwidth is increased, calibration will be maintained.

380 Frequency ____________

	Reading	Reading -3 dB	Check
Offset			
1 kHz	______	__________	______
10 kHz	______	__________	______
100 kHz	______	__________	______

4-11. OUTPUT LEVEL ACCURACY AND LEVELING.

Test Equipment Required

Power Meter	Booton 42

1. Connect a power meter to the 380 RF OUTPUT connector through a calibrated 10 dB pad.

2. Set the output frequency to 1 MHz, and frequency increment to 10 MHz. Turn on the control knob.

3. Set the 380 output level to +5 dBm.

4. Slowly tune the 380 across its frequency range. Record the maximum and minimum power readings, and the frequency.

380 Setting, +5 dBm
Acceptable Readings, +2.0 to 8.0 dBm
Acceptable Leveling, $\frac{\text{Max} - \text{Min}}{2}$, ± 2.5 dBm

Maximum Level __________ Frequency ____________
Minimum Level __________ Frequency ____________
Check ______________

5. Repeat for a setting of 0 dBm.

Acceptable Readings, -3 to +3 dBm
Acceptable Leveling, ± 2.5 dBm

Maximum Level __________ Frequency ____________
Minimum Level __________ Frequency ____________
Check ______________

6. Repeat for a setting of -5 dBm.

Acceptable Readings, -8 to 2 dBm
Acceptable Leveling, ± 2.5 dBm
Maximum Level ______________ Frequency ________________
Minimum Level ______________ Frequency ________________
Check ________________

4-12. AM MODULATION.

Test Equipment Required

Function Generator	Wavetek 180
Modulation Meter	Booton 82AD

1. Set a function generator for 1.0 Vrms output at 4 kHz and connect it to the 380 RF Section AM MOD IN connector. (Figure 4-3)
2. Set the 380 for 100 MHz at +5 dBm.
3. Connect the RF OUTPUT to a modulation meter.
4. Set the 380 for 75% Modulation at EXT and record the reading. Repeat for 400 and 1000 Hz Internal.
5. Record the % AM. Acceptable readings are 70% to 80%.

EXT ______________
400 ______________
1000 ______________
Check ________________

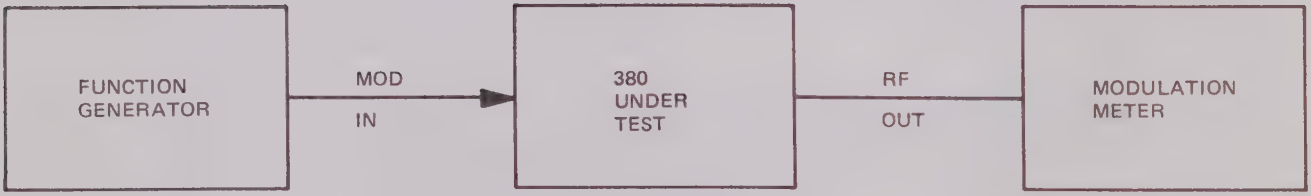


Figure 4-3. Modulation Test Setup

4-13. FM MODULATION.

Test Equipment Required

Function Generator	Wavetek 180
Modulation Meter	Booton 82AD

1. Set the function generator for a 1.0 Vrms output at 4 kHz and connect it to the 380 RF Section AM MOD IN connector.
2. Set the 380 for 100 MHz at +5 dBm.
3. Connect the RF OUTPUT to a modulation meter.
4. Set the 380 for the deviation shown at EXT Mod, FM positions.
5. Record the results.

		Accuracy
7.5 kHz	________	± 0.5 kHz
75 kHz	________	± 5.0 kHz

Check ____________

4-14. PHASE MODULATION.

Test Equipment Required

Counter	Systron Donner 6244A
Function Generator	Wavetek 180
Modulation Meter	Booton 82AD

1. Using the same test setup as indicated in Figure 4-3, set the 380 for phase modulation, EXT input.
2. Measure the frequency of the function generator on a counter and set it to 7.5 kHz ± 100 Hz.
3. Set the function generator for 1.0 Vrms and connect it to the 380 EXT MOD input connector.
4. Set the 380 for 57.5° (1 radian).
5. Record the results, readings should be within 7.5 kHz ± 0.5 kHz.

Reading ______ Check __________

CHAPTER 5

SYSTEM CALIBRATION AND ADJUSTMENTS

5-1. INTRODUCTION

5-2. This chapter details the calibration procedures necessary to verify that the instrument is operating properly and within its prescribed operating limits. AILTECH recommends that these procedures be performed every six months or 1000 hours of operation.

5-3. This chapter covers calibration and adjustment procedures for the following:

a. Mainframe

b. RF Section

c. PM 3602 Modulator

5-4. Table 1-5 contains a tabular listing of test equipment and test accessories required for the calibration and adjustment procedures. In addition, the table contains the required minimum specifications and a suggested manufacturer's model number.

5-5. MAINFRAME

5-6. **POWER SUPPLY VOLTAGE.** This procedure provides the necessary information to adjust the three power supply voltages.

Test Equipment Required	
Digital Voltmeter	Systron Donner 7004

1. Allow the 380 to warmup in the ON mode for at least one hour.
2. Using a Phillips head screwdriver, remove top and rear covers.
3. Connect a digital voltmeter (DVM) between terminal A4FL2 and ground on the top rear of the A4 module (Figure 6-6).
4. Adjust potentiometer A11A3R9 on –12 volt regulator PC board (right hand board) for a reading of –12Vdc ± 1 mV (Figure 6-6).
5. Connect the digital voltmeter between terminal A4FL1 and ground.
6. Adjust potentiometer A11A2R10 on +5.2 volt regulator PC board (left hand board) for a reading of +5.3Vdc ± 1 mV (Figure 6-6).
7. Remove two Phillips head screws and protective cover, identified as CAUTION HIGH VOLTAGE from the rear power supply.

8. Connect a digital voltmeter between the rear terminal of the terminal strip and ground.

9. Adjust potentiometer R8 on the rear of the power supply for a reading of 5.1Vdc ± 50 mV.

5-7. **SWEEP OUTPUT VOLTAGE.** This procedure sets the sweep output voltage for a 0 volt offset.

Test Equipment Required

Digital Voltmeter	Systron Donner 7004

1. Connect a digital voltmeter to the SWP OUT BNC connector on the 380 rear panel.

2. Using the front panel keyboard, set in a START frequency of 1 MHz, a STOP frequency of 100 MHz, 100 NO. OF STEPS and MAN SWEEP.

3. Rotate the TUNING knob and set the frequency 1 MHz.

4. Adjust potentiometer A15A2R6 on the latch PC board (the middle board of three boards mounted on the rear of the 380) for a reading of 0 Vdc ± 10 mV.

5. Rotate TUNING knob and set frequency at 100 MHz. Digital voltmeter should read 2.0 Vdc ± 10 mV.

5-8. **24/33 MHz OSCILLATOR.** The following steps detail the procedure for setting the ten free running oscillators to specifications.

Test Equipment Required

Frequency Counter	Systron Donner Model 6244A

1. Turn the 380 on its left side and remove the bottom cover.

2. Remove the coaxial cable from connector A10J11 24/33 MHz IN from the HF SUB ASSY A10 module.

3. Connect a frequency counter to the disconnected coaxial cable using a suitable coaxial adapter.

4. Using the keyboard, set in a frequency of 30 MHz, and set in a tuning increment of 1 MHz.

5. Using the ⇧ or OFF ⇩ keys, step through the range of 30 to 39 MHz, adjusting the appropriate capacitor to the frequency in Table 5-1. Since the long term frequency drift is negative, set each oscillator approximately 10 kHz higher than nominal.

TABLE 5-1. NOMINAL OSCILLATOR FREQUENCIES

Frequency Selected (MHz)	Nominal Frequency	Adjustment Capacitor on A6A1
30.0000000	24	C19
31.0000000	25	C35
32.0000000	26	C39
33.0000000	27	C15
34.0000000	28	C11
35.0000000	29	C7
36.0000000	30	C3
37.0000000	31	C23
38.0000000	32	C27
39.0000000	33	C31

5-9. 10 MHz FREQUENCY STANDARD (OPTION 002 or 003). All frequencies generated by the 380 are derived from a 10 MHz oven controlled frequency standard. This adjustment sets the internal standard to within 1 x 10^{-9} of the house standard.

Test Equipment Required

Frequency Counter	Systron Donner Model 6244A

1. Allow the 380 to warmup for at least two hours.
2. Remove the rear cover to permit access to the internal oscillator.
3. Connect a frequency counter, referenced to the house standard, to the 380 RF section RF OUTPUT connector on the front panel.
4. Set the 380 for 100 MHz, CW at a suitable output level.
5. Remove the cap screw from the reference oscillator.
6. Set the frequency counter for ± 1 Hz resolution (1 second gate time) and adjust the reference oscillator for a counter reading of 100.000000 MHz (1 x 10^{-8} accuracy).
7. For the 180 MHz RF Section, set the counter for ± 0.1 Hz resolution (10 second gate time) and further adjust the reference oscillator for 100.0000000 MHz ± (1 x 10^{-9} accuracy).
8. For the 1.8 MHz and 2.0 GHz RF Sections, set the frequency to 1 GHz, the counter for ± 1 Hz resolution (1 second gate time) and adjust for 1000.000000 MHz +1.0 Hz (1 x 10^{-9} accuracy).

5-10. RF SECTIONS 180, 1800, and 2000 MHz ADJUSTMENTS.

5-11. VHF OSCILLATOR A5. This procedure is used to set the frequencies of the drift cancellation oscillator A5.

Test Equipment Required

Frequency Counter	Systron Donner Model 6244A

1. Remove the two cables from connectors J4 and J5 on the rear panel of the RF section.
2. Remove the RF section and reconnect to the mainframe using extender cables 298822, 296551-1 and 296551-2.
3. Connect a frequency counter to connector A5J1 (located on bottom of RF section) and set the counter resolution to 1 kHz.
4. Allow sufficient warmup time (1 hour).
5. Set the 380 to the frequencies listed in Table 5-2 for the appropriate RF section.
6. Adjust the oscillator frequencies approximately 500 kHz higher than the nominal frequency.
7. For the 1800 and 2000 MHz RF sections, the 305 MHz oscillator is adjusted 850 kHz higher than the nominal frequency.

TABLE 5-2. VHF OSCILLATOR FREQUENCIES

380 Output Frequency	VHF OSC Nominal Frequency	Adjustment Capacitor on A5A1
180 MHz RF SECTION		
160 MHz	305 MHz	C59
140 MHz	315 MHz	C60
120 MHz	325 MHz	C63
100 MHz	335 MHz	C62
80 MHz	345 MHz	C61
60 MHz	355 MHz	C68
20 MHz	365 MHz	C67
10 MHz	375 MHz	C66
1 MHz	385 MHz	C65
1800 MHz RF SECTION		
800 MHz	305 MHz*	C59
700 MHz	315 MHz	C60
600 MHz	325 MHz	C63
500 MHz	335 MHz	C62
400 MHz	345 MHz	C61

*Refer to paragraph 5-11, step 7.

TABLE 5-2. VHF OSCILLATOR FREQUENCIES (Cont)

380 Output Frequency	VHF OSC Nominal Frequency	Adjustment Capacitor on A5A1
1800 MHz RF SECTION (Cont)		
320 MHz	355 MHz	C67
20 MHz	365 MHz	C66
10 MHz	375 MHz	C65
1 MHz	385 MHz	C64
2000 MHz RF SECTION		
900 MHz	305 MHz*	C64
800 MHz	315 MHz	C59
700 MHz	325 MHz	C60
600 MHz	335 MHz	C63
500 MHz	345 MHz	C62
400 MHz	355 MHz	C61
30 MHz	365 MHz	C68
20 MHz	375 MHz	C67
10 MHz	385 MHz	C66
1 MHz	395 MHz	C65

*Refer to paragraph 5-11, step 7.

5-12. DOUBLER DRIVE LEVEL ADJUSTMENT, 1800 AND 2000 MHz RF SECTIONS. Adjusts the drive level for the 900 to 1800 MHz and 1000 to 2000 MHz ranges for the 1800 and 2000 MHz RF Sections. Normally performed after a repair or replacement of A8A1 frequency scaler.

Test Equipment Required

Power Meter	Dana Model 9008

1. Remove the two connectors J4 and J5 from the rear of the RF section, and remove the RF section from the mainframe.
2. Connect the RF section to the mainframe using extender cables 298822, 296551-1 and 296551-2.
3. Using proper adapters from the Service Kit 299252, disconnect the cable to connector A8J4, and connect a power meter to connector A8J4.
4. Set the 380 to the highest operating frequency, 1799 or 1999 MHz.

5. Set potentiometer A8A1R87 on the side cover of A8 output section fully clockwise.

6. Adjust potentiometer A8A1R87 in a counterclockwise direction until the power reading decreases by 0.5 dB, or reaches -10 dBm, whichever occurs first.

7. Reassemble the RF section.

5-13. OUTPUT LEVEL AND AMPLITUDE MODULATION ADJUSTMENTS

5-14. Output level and amplitude modulation adjustments are performed first using the RF front panel and modulation controls. Next, the adjustments for output level and amplitude modulation are performed using the keyboard.

Test Equipment Required

10 dB Coaxial Attenuator	Narda
Digital Voltmeter	Systron Donner Model 7004
Function Generator	Wavetek Model 180
Modulation Meter	Dana Model 9008
Power Meter	Boonton Model 42B
Spectrum Analyzer	AILTECH 757

5-15. OUTPUT LEVEL, RF FRONT PANEL CONTROL, 180 MHz RF SECTION.

1. Remove the right side panel and top cover from the 380.

2. Allow the instrument to warmup for at least one hour before making any adjustments.

3. Set the output frequency to 100 MHz.

4. Activate the RF PANEL controls using the SHIFT AND PANEL/LOCAL keys.

5. Set the modulator MODE switch to the CW position.

6. Connect the power meter and a calibrated 10 dB attenuator to the RF OUTPUT connector.

7. Connect a digital voltmeter to A8FL3 (second terminal from rear on top of A8) and ground, and set for dc volts.

8. Set the 10 dB step switch to +10 dBm (181 option only).

9. Set the OUTPUT LEVEL (vernier) control fully clockwise.

10. Record digital voltmeter reading. ________________Vdc

11. Set the OUTPUT LEVEL (vernier) control fully counterclockwise. Adjust potentiometer A3R8 for a DVM reading which is 1/10 the voltage recorded in step 10.

12. Adjust linearity control potentiometer A8R73 (access through cover of A8) for a power output of -7 dBm.

13. Set the OUTPUT LEVEL (vernier) control fully clockwise, and readjust potentiometer A3R3, if necessary for a power output of + 13 dBm.
14. Repeat steps 12 and 13 until the levels of steps 12 and 13 are achieved.
15. Disconnect the DVM, and set the OUTPUT LEVEL (vernier) control fully counterclockwise. Adjust potentiometer A3R8 for a power output of 0 dBm.
16. Set OUTPUT LEVEL (vernier) fully clockwise. Power output should be +13 dBm, if not, readjust potentiometer A3R3.
17. Repeat steps 15 and 16 until no further adjustment is necessary.

5-16. AMPLITUDE MODULATION LINEARITY, 180 MHz RF SECTION.

1. Activate RF panel controls using the SHIFT and PANEL/LOCAL keys.
2. Set MODE switch to AM position.
3. Set the SOURCE switch to EXT position, MOD LEVEL control fully clockwise (PM3602 only).
4. Set the OUTPUT LEVEL (vernier) control fully clockwise. Set the OUTPUT LEVEL (10 dB Step) control to +10 dBm (181 option only).
5. Set the function generator for a 5 kHz sinewave at a level of about 1 Vrms and connect to the MOD IN front panel connector.
6. Set the 380 for 100 MHz output frequency.
7. Connect the modulation meter or spectrum analyzer to the RF OUTPUT connector on the front panel.
8. Adjust the modulation meter for AM, or adjust the spectrum analyzer to 100 MHz center frequency, 10 kHz division, 5 dB/division and a 1 kHz bandwidth.
9. With the OUTPUT LEVEL (vernier) control fully clockwise adjust the level of the function generator into the MOD IN connector for a 70% AM reading on the modulation meter, or if a spectrum analyzer is used, adjust for modulation sidebands 9 dB below the carrier (70% modulation).
10. Set the OUTPUT LEVEL (vernier) control fully counterclockwise. The modulation reading will probably change from 70% as read on the modulation meter or spectrum analyzer.
11. Adjust linearity control potentiometer A8R73 for 70% modulation.
12. Repeat steps 9, 10, and 11 until 70% modulation is obtained with the OUTPUT LEVEL (vernier) control at fully counterclockwise or fully clockwise positions.
13. Disconnect the function generator, the modulation meter or spectrum analyzer and connect the power meter (using a 10 dB pad).

14. Set the OUTPUT LEVEL (vernier) control fully clockwise. Power should read +13 dBm. If not, adjust potentiometer A3R3.

15. Set the OUTPUT LEVEL (vernier) control fully counterclockwise. Power should read 0 dBm. If not, adjust potentiometer A3R8.

16. Connection function generator, modulation meter or spectrum analyzer, and recheck AM linearity and level, steps 9 through 16, until no further adjustment is required.

5-17. OUTPUT LEVEL, RF FRONT PANEL CONTROL, 1800 AND 2000 MHz RF SECTIONS.

1. Remove the right side panel and top cover from the 380.

2. Allow the instrument to warmup for a least one hour before making any adjustments.

3. Set the output frequency to 1.0 GHz.

4. Activate the RF PANEL controls using the SHIFT and PANEL/LOCAL keys.

5. Set the modulator MODE switch to the CW position.

6. Connect the power meter and a calibrated 10 dB attenuator to the RF OUTPUT connector.

7. Locate Low Level Set potentiometer A3R8 on the right side of the 380 and adjust potentiometer to maximum clockwise position.

8. Remove three hold down screws from the logic converter PC board A9 in the top of the RF section, and lift PC board to provide access to LIN ADJ potentiometer:

1800 MHz	A8A2R3
2000 MHz	A8A2R33

Take care to ensure that all connectors on logic PC board remain connected.

9. Set the 10 dB step switch on RF section front panel to 0 dBm. (180 series option only).

10. Set OUTPUT LEVEL (vernier) to the +5 dBm position.

11. Adjust High Level Ref potentiometer A3R3 on right side of 380 for a +5 dBm output as read on power meter.

12. Rotate OUTPUT LEVEL (vernier) fully counterclockwise (minimum power).

13. Adjust LIN ADJ potentiometer A8A2R3, R33 (under logic converter PC board) for –6 dBm output. (0 dBm for instruments without 180 series attenuator).

14. Repeat steps 10 through 13 until 1 to 2 dB above correct reading of minimum output level.

15. Adjust Low Level Set potentiometer A3R8 on right side of instrument for correct power at minimum level.

5-18. AMPLITUDE MODULATION LINEARITY 1800 AND 2000 MHz RF SECTIONS.

1. Activate RF PANEL controls by using the SHIFT and PANEL/LOCAL keys (RF PANEL LED on).
2. Set MODE switch to AM position.
3. Set SOURCE switch to EXT position.
4. Set OUTPUT LEVEL (vernier) to the +5 dBm position.
5. Set the function generator for a 5 kHz sinewave at a level of about 1 Vrms and connect to the MOD IN front panel connector.*
6. Set the 380 output frequency to 1.0 GHz.
7. Connect the modulation meter or the spectrum analyzer to the RF OUTPUT connector on the front panel.
8. Adjust the modulation meter for AM or adjust the spectrum analyzer to 1 GHz center frequency, 10 kHz/division, 5 dB/division and 1 kHz bandwidth.
9. Adjust the level of the function generator into the MOD IN connector for a 70% AM reading on the modulation meter, or if a spectrum analyzer is used, adjust for modulation sidebands 9 dB below the carrier (70% modulation).
10. Rotate the OUTPUT LEVEL (vernier) fully counterclockwise (minimum power). The modulation reading will probably change from 70% as read on the modulation meter, or spectrum analyzer.
11. Adjust LIN ADJ potentiometer A8A2R3 or A8A2R33, (located under the logic converter PC board A9) for 70% modulation.
12. Disconnect the function generator, and the modulation meter or spectrum analyzer.
13. Connect the power meter through a 10 dB pad to the RF OUTPUT connector.
14. Readjust Low Level Set potentiometer A3R8 on the right side of the instrument for a correct power reading with the OUTPUT LEVEL (vernier) control at minimum power (fully counterclockwise).
15. Set the OUTPUT LEVEL (vernier) to the +5 dBm position.
16. Adjust High Level Ref potentiometer A3R3 for a +5 dBm measured power.
17. Re-connect the function generator to the MOD IN connector.
18. Connect the modulation meter or spectrum analyzer to the RF OUTPUT connector.
19. Adjust the level of the function generator into the MOD IN connector for 70% modulation reading on the modulation meter or spectrum analyzer.

*Use a dc block to remove any direct voltage component from the function generator output.

20. Repeat steps 10 through 19 until the modulation reading without further adjustment is within 68 to 72%.

5-19. AM METER CALIBRATION.

1. Set a function generator for a 5 kHz sinewave at a level of 1 Vrms (using the DVM) and connect to the MOD IN connector.*
2. Activate RF panel controls by depressing SHIFT AND PANEL/LOCAL keys.
3. Set MODE switch to AM position.
4. Set SOURCE switch to EXT position.
5. Set MOD LEVEL control fully clockwise.
6. Remove top front bezel strip (3 Phillips head screws) and locate Meter Cal Adj potentiometer A4R30 on top of modulator. (Refer to PM3602 manual, Figure 4-14 for potentiometer A4R30 location).
7. Carefully adjust Meter Cal Adj potentiometer A4R30 for a full scale reading on the front panel. Tap the meter gently to obtain an accurate setting.
8. Set the OUTPUT LEVEL (vernier) to the -5 dBm position for 180 MHz/0 dBm for 1800, 2000 MHz, and the OUTPUT LEVEL (10 dB Step) control for highest power (fully clockwise).
9. Connect the modulation meter or spectrum analyzer to the RF OUTPUT connector.
10. Carefully adjust the function generator output level to 0.7 Vrms, using the DVM.
11. Adjust AM Set potentiometer A3R4 on the right side of the instrument for a 70% ± 3% reading on the modulation meter or spectrum analyzer, at OUTPUT LEVEL (vernier) settings +5, 0 and -5 dBm, for 1800/2000 MHz RF sections, and -10, -5, and 0 dBm, for 180 MHz RF sections.

5-20. KEYBOARD CALIBRATION OF OUTPUT LEVEL AND AM FOR 180, 1800 AND 2000 MHz RF SECTIONS. Calibrates output level and AM to the keyboard controls. These adjustments are performed after the adjustments in paragraphs 5-15, 5-18, and 5-19 have been completed.

1. Set the 380 using keyboard entry (RF Panel LED OFF) for a frequency of 100 MHz for 180 MHz RF Section and 1000 MHz for the 1800/2000 MHz RF Section. Set power to 0 dBm, 70% AM, and modulator SOURCE switch to EXT. Allow at least 1 hour warmup.
2. Set a function generator for a 5 kHz sinewave and set the level accurately to 1.0 Vrms with the digital voltmeter. Connect to the MOD IN connector.
3. Locate REM CAL ADJ potentiometer A4R35, and integrated circuit A4U3 pin 15, on top of modulator section. (Refer to PM3602 manual Figure 4-14 for parts location).

*Use a dc block to remove any direct voltage component from the function generator output.

4. Connect a digital voltmeter between integrated circuit A4U3 pin 15 and ground.
5. Adjust REM CAL ADJ potentiometer A4R35 for a 0.7 Vrms reading on the digital voltmeter.
6. Activate the RF panel controls for Level and Modulation. (Shift Panel/Local, LED ON).
7. Set the MODE switch to the CW position.
8. Connect the power meter to the RF OUTPUT connector and adjust the OUTPUT LEVEL (vernier) for a +5 dBm reading on the power meter for 180 MHz RF Sections, and 0 dBm for 1800/2000 MHz RF Sections.
9. Disconnect the power meter and connect the modulation meter or spectrum analyzer to the RF OUTPUT connector.
10. Set the MODE switch to the AM position and adjust the MOD LEVEL control for 70% ± 1% modulation as read on the external modulation meter or spectrum analyzer. (Sidebands 9 dB below carrier)
11. Locate terminal A8FL3, REF IN for 180 MHz RF Section, or A8FL7 for 1800/2000 MHz RF Sections. The terminals are located at the top right rear corner of the instrument adjacent to programming connectors J4 and J5. Refer to the appropriate RF Section manuals for location of the above terminal.
    - a Terminal A8FL3 REF IN, P360180E1 manual, pages 4-14 and 4-61.
    - b Terminal A8FL7 LEV REF, P3601.8E1 and P3602.0E1 manuals, pages 4-11 and 4-63.
12. Set a digital voltmeter for AC volts, and connect it to terminal A8FL3 and ground for 180 MHz RF Section or terminal A8FL7 and ground for 1800 or 2000 MHz RF Sections. Record the voltage to ±1 mV. ________VAC
13. Set 380 for keyboard entry.
14. Using the keyboard entry, enter power levels of +5 dBm for 180 MHz RF Section, or 0 dBm for 1800/2000 MHz RF Sections.
15. Set amplitude modulation level to 70%, modulation source to EXT, using the 380 keyboard controls.
16. Lift logic converter PC Board A9 to expose Remote High Level potentiometer A13R13 and Remote Low Level potentiometer A13R14.
17. Adjust Remote High Level potentiometer A13R13 (front potentiometer) for the same AC voltage recorded in step 12.
18. Disconnect the function generator input from the MOD IN connector, and disconnect modulation meter or spectrum analyzer from the RF OUTPUT connector.
19. Connect a power meter to the RF OUTPUT connector, through a 10 dB pad.

20. Adjust Remote Low Level potentiometer A13R14 (rear potentiometer) for +5 dBm for 180 MHz RF Section and 0 dBm for 1800/2000 MHz RF Sections, as measured on the power meter.

21. Using the keyboard, enter power levels of +10 dBm and 0 dBm for 180 MHz RF Sections, and +5 dBm, and -5 dBm for 1800/2000 MHz RF Sections. Record the dB error of both levels as read on the power meter. Split the difference and readjust Remote High Level potentiometer A13R13 to minimize error.

22. Disconnect the power meter from the RF OUTPUT connector and connect the modulation meter or spectrum analyzer to the RF OUTPUT connector.

23. Connect the function generator to the MOD IN connector, set at the previous frequency and level.

24. Using keyboard entry set for 70% EXT AM, and check modulation readings at output levels of 13, 5 and 0 dBm for 180 MHz RF Section and for 1800/2000 RF Sections +5 dBm and -5 dBm. Readings should be within 5%. If this cannot be obtained, slight readjust LIN ADJ potentiometer:

    a 180 MHz Plug In, A8A2R73

    b 1800 MHz Plug In, A8A2R3

    c 2000 MHz Plug In, A8A2R33

25. If a modulation meter is used, set keyboard for 70% AM, Internal 400 or 1000 Hz Source. Set output level for 0 dBm. Modulation meter reading should be within 68 to 72%. If not, slightly readjust potentiometer A13R13.

26. Disconnect modulation meter or spectrum analyzer, and connect the power meter to the RF OUTPUT connector.

27. Using keyboard entry set in a power level +13 dBm for 180 MHz RF Sections and +3 dBm for 1800/2000 MHz RF sections. Set MODE switch to CW position. (Shift CW/FREQ.)

28. Set the output frequency to 1.0 MHz.

29. Using the increment set function, set in an increment of 1 MHz for 180 MHz, RF Section and 5 MHz for 1800/2000 MHz RF Sections.

30. Energize the TUNING knob.

31. Manually sweep the frequency through the full range starting at 1.0 MHz, in the preset increments.

32. Record the highest power level and frequency and the lowest power level and the frequency. The readings should be between 11.5 dBm and 14.5 dBm (13 dBm ± 1.5 dB) for 180 MHz RF Sections and 0 dBm and 6 dBm (3 dBm ± 3 dB), for 1800/2000 MHz RF Sections.

33. To equalize the variation in both directions, determine the amount and direction of the required change. Set the keyboard for 100 MHz for the 180 MHz RF Section and 1.0 GHz for 1800/2000 MHz RF Sections. Set output for +13 dBm for 180 MHz RF Section and +3 dBm for 1800/2000 MHz RF Sections.

34. Adjust the Remote High Level Set potentiometer A13R13 for the required change as read on the power meter. Record the power reading _____dBm.

35. Transfer control to the RF panel. (Shift PANEL/LOCAL, LED on)

36. Set MODE switch to the CW position.

37. Set the OUTPUT LEVEL (vernier) to +13 dBm for 180 MHz RF Sections, and +3 dBm for 1800/2000 MHz RF Sections.

38. Adjust High Level Ref potentiometer A3R3 on the right side of the instrument for the same power reading as in step 33.

39. Recheck steps 31 and 32.

5-21. PM3602 MODULATOR ADJUSTMENTS

5-22. DESCRIPTION. This procedure calibrates the 400 and 1000 Hz internal oscillator, adjusts the loop gain and center frequency of the FM oscillator, and calibrates the modulation meter and LED display for FM and ϕM.

5-23. 400 Hz and 1000 Hz INTERNAL OSCILLATOR.

Test Equipment Required

Cable Assembly	AILTECH 299543-3
Digital Voltmeter	Systron Donner 7004
Extender Cable	AILTECH 299820
Frequency Counter	Racal Dana 7720

1. Allow the 380 to warmup in the operate mode for a least one hour.
2. Remove the PM3602 Modulator from the 380 and reconnect it to the 380 using the extender cable.
3. Disconnect coaxial connectors and power connector A4P6 of phase lock loop A2 assembly.
4. Remove three screws securing A2 assembly and swing assembly aside.
5. Using keyboard entry, set for AM modulation, 70% Internal 400 Hz.
6. Connect a frequency counter to modulation oscillator connector A1A3J7 and adjust 400 Hz ADJ potentiometer A1A3R4 for a counter reading of 400 ± 4 Hz.
7. Using keyboard entry, set for 1 kHz internal modulation.

8. Adjust 1000 Hz ADJ potentiometer A1A3R5 for a counter reading of 1000 ± 10 Hz. Reconnect internal cable to connector A1A3J7.
9. Connect a digital voltmeter to pin 15 of A4U3. (See Figure 4-14 of PM3602 manual for location).
10. Set the digital voltmeter for AC volts, 1.0 Vrms scale.
11. Adjust LEVEL ADJ potentiometer A1A3R13 for a voltmeter reading of 0.70 Vrms ± 0.01V.
12. Check that the modulation oscillator shuts off when EXT SOURCE is entered. Also in CW MODE with either 400 or 1000 Hz Internal.
13. Reconnect the A2 assembly.

5-24. **MODULATION METER CALIBRATION.** Refer to paragraph 5-19, steps 1 through 7 and follow the procedure for AM meter calibration.

5-25. **FM PHASE LOCK LOOP ADJUSTMENT.**

Test Equipment Required

Adapter BNC Female to SMB Plug	294677
Adapter SMB Tee	294678
Cable Assembly	AILTECH 299453-3
Digital Voltmeter	Systron Donner 7004
Frequency Counter	Dana 7720

Insulated board — to protect modulator

1. Remove top cover from 380.
2. Remove PM3602 Modulator, place on top of 380 using the insulated board, and reconnect modulation section connector. Do not use extender cable.
3. Transfer control to RF Panel (SHIFT PANEL/LOCAL, LED on).
4. Set modulator MODE switch to FM, SOURCE switch to EXT, PEAK DEVIATION to 10 KHz, and MOD LEVEL full counterclockwise.
5. Remove coax cables from A2J3 and A2J5 and connect cables together using the Tee adapter, AILTECH part number 294678.
6. Connect a frequency counter to connector A2J3.
7. Adjust 29 MHz VCO tuning capacitor A2A1C9 for a counter reading of 29 MHz ± 5 kHz.
8. Disconnect frequency counter from connector A2J3.

9. Connect 380 RF output to connector A2J5.
10. Set OUTPUT LEVEL for 0 dBm at 29.000 MHz.
11. Connect a digital voltmeter to test point A2A3TP1 and set the digital voltmeter for the 1.0 Vdc range.
12. Record voltage to within 0.1 mV. (Voltage will be about 0 volts ± 50 mV).
13. Change frequency to 29.1 MHz and record new voltage at TP1. The difference between the voltage readings at 29.0 MHz and 29.1 MHz should be 12.5 mV ± 1.0 mV.
14. If the voltage difference is not within 12.5 ± 1.0 mV, adjust GAIN ADJ potentiometer A2A3R13 in small increments until the difference is within the tolerance.
15. Connect frequency counter to connector A2J3.
16. Set 380 for 28.0 MHz and slowly increment the frequency upward in 100 kHz steps until counter reading is the same as the 380 frequency, indicating phase lock.
17. Record this frequency. It should be less than 28.7 MHz.
18. Set 380 for 29.9 MHz and slowly increment the frequency lower in 100 kHz steps until the counter indicates phase lock, as above. This frequency should be greater than 29.3 MHz.
19. If the requirements of steps 15 through 18 are not achieved, repeat steps 6 through 14.
20. Reconnect all modulator cables.

5-26. FM CALIBRATION.

Test Equipment Required	
Digital Voltmeter	Systron Donner 7004
Frequency Counter	Dana 7720
Function Generator	Wavetek 180
Spectrum Analyzer	AILTECH 757
Modulation Meter	Dana Model 9008

1. Activate the keyboard for control of output level and modulation (RF PANEL LED off).
2. Using keyboard entry, set the 380 frequency to 40 MHz, FM at a deviation of 70 kHz and EXT SOURCE. If a modulation meter is available, calibrate using either the 400 Hz or 1 kHz Internal Source. In this case, proceed to step 3.
3. Using a frequency counter and a digital voltmeter, adjust a sinewave generator (function generator) for an output frequency of 29.14 kHz, and a level of 1.0 Vrms and connect it to the MOD IN connector on the front panel.

4. Locate integrated circuit A4U11, FM STEREO SEPARATION ADJ potentiometer A4R38, and connector A4J3 on the logic control PC board A4 (front left side of the modulator).
5. Place 380 in STBY mode, and using an ohmmeter, connect the leads between A4U11 pin 10, and connector A4J3.
6. Adjust FM STEREO SEPARATION ADJ potentiometer A4R38 for a nominal 200 ohms.
7. Place 380 in ON mode, and connect the digital voltmeter, set for AC volts, between connector A4J3 and ground.
8. Locate BAND 1 CAL ADJ potentiometer A4R6 on the logic control PC board A4 and adjust for 0.07 Vrms. (This assumes that REM CAL ADJ potentiometer A4R35 has been adjusted as per the AM calibration paragraph 5-19).
9. Connect a modulation meter or a spectrum analyzer to the 380 RF OUTPUT connector and tune to 40 MHz. Set analyzer scan width to 30 kHz/div., and center signal on CRT display.
10. Loosen two thumbscrews on front of modulator and remove rear bracket screw. Slide forward from RF section exposing FM SENSITIVITY ADJ potentiometer A2A1R10 on bottom of modulator.
11. Adjust R10 for 70 kHz deviation as read on the modulation meter, or the first carrier null as observed on the spectrum analyzer.
12. Replace modulator in RF section.

5-27. **STEREO SEPARATION ADJUSTMENT.** This adjustment can be used to optimize stereo separation when the synthesizer is modulated with an FM Stereo Multiplex signal. The FM STEREO SEPARATION ADJ potentiometer A4R38 is located on logic control PC board A4. (For location refer to PM3602 manual, Figure 4-14). The control is set at the factory for a nominal resistance of 200 ohms.

1. Unfasten the PM3602 Modulator front panel screws, and the modulator rear bracket screw, and slide the modulator forward slightly to allow access to potentiometer A4R38.
2. Connect an FM stereo multiplex signal to the MOD IN connector.
3. Using keyboard entry, set for FM mode, 70 kHz deviation, EXT SOURCE.
4. Connect 380 to an FM deviation meter with a stereo decoder. Follow normal procedure for measuring separation. If separation is less than 40 dB, adjust R38 for best separation, 40 to 48 dB.
5. Adjustment of R38 will somewhat affect the FM calibration. If necessary, repeat paragraph 5-26, however, adjust BAND 1 CAL ADJ A4R6 instead of R10 in step 11, for correct calibration.
6. Adjust BAND 1 CAL ADJ potentiometer A4R6 located on the top PC board, for the first carrier null.

5-28. PHASE MODULATION CALIBRATION.

Test Equipment Required	
Digital Voltmeter	Systron Donner 7004
Function Generator	Wavetek 180
Extender Cable	AILTECH 299820
Spectrum Analyzer	AILTECH 757

1. Using a Phillips head screwdriver, remove two black flathead screws securing modulation front panel.
2. Carefully pull front panel clear of modulator, being careful not to put excessive strain on connecting wiring. Rest panel on a suitable support.
3. Activate keyboard for control of RF output, level and modulation (RF PANEL LED off).
4. Set the 380 to 100 MHz, phase modulation, 138.0 degrees, EXT SOURCE.
5. Connect a digital voltmeter, set for DC volts, between test point A1A2TP1, located next to A2R9 and ground.
6. Adjust VARACTOR BIAS potentiometer A1A2R18 for a reading of approximately -3Vdc.
7. Set the function generator to approximately 20 kHz, and connect it to the front panel MOD IN connector.
8. Connect the spectrum analyzer to the 380 front panel RF OUTPUT connector, tune for 100 MHz, and set the analyzer for a scan width of 30 kHz/div.
9. Starting with a low function generator level, increase the function generator output until the first carrier null is observed on the analyzer.
10. Adjust the function generator DC offset in conjunction with output level, to obtain the lowest carrier null.
11. Switch off the DC offset on the function generator. Preferably use a DC block, as any small offset will cause a calibration error.
12. Readjust VARACTOR BIAS ADJ potentiometer A1A2R18 for the lowest null depth observed in step 10.
13. Adjust linearity potentiometers A1A2R3 and R9 to increase the depth of the null.
14. Accurately set the function generator level into the front panel MOD IN connector to 1.0 Vrms. Use a DC block to eliminate any residual DC voltage which will cause an error in calibration.

15. Locate the ϕMOD SENS ADJ potentiometer A1A2R22, on the top right hand side of the modulator housing.
16. With the 380 still set for 137.5 degrees phase modulation, set ϕMOD SENS ADJ potentiometer R22 for the first carrier null.
17. Reassembly the front panel to the modulator using a Phillips head screwdriver and two black flathead screws.

CHAPTER 6

MAINTENANCE

6-1. INTRODUCTION

6-2. This chapter contains maintenance information for the 380K11 Mainframe and the 3600E1 Frequency Extender. The maintenance philosophy used provides defined troubleshooting procedures to isolate a malfunction to a card or subassembly, then provides sufficient test data on each card or subassembly to allow a technician to further troubleshoot to a faulty component. To achieve these goals, this chapter contains the principles of operation of the signal generator and frequency extender to familiarize the technician with the operation of the units; a troubleshooting chart to isolate a malfunction to a card or subassembly; complete photographs of the units so that the technician can identify a faulty card or subassembly; principles of operation of each card and subassembly along with schematic diagrams, critical test data, service block diagrams, and parts location diagrams to enable the technician to isolate a malfunction to a particular component. In addition, this chapter contains several critical performance tests and adjustments to enable the technician to maintain the signal generator and frequency extender in optimum operating condition.

6-3. PRINCIPLES OF OPERATION

6-4. **SYNTHESIZED SIGNAL GENERATOR MAINFRAME.** (Figure 6-1.) The 380K11 Synthesized Signal Generator Mainframe produces an output between 35 and 36 MHz selectable in 1.0-Hz increments (0.1 Hz with option -001). The basis for the extremely high accuracy of the 380K11 Synthesized Signal Generator is 10-MHz standard oscillator A13 (-002 or -003 option). This oscillator is a highly stable, crystal-controlled oscillator in a proportionally controlled oven. If the -002 or -003 option is not included, an external 5-MHz or 10-MHz reference source may be used. The accuracy of the frequency synthesizer depends on the accuracy of the reference source used.

6-5. The reference output is applied to fixed frequency generator input board A5A1, where the 10-MHz signal is amplified and filtered before being distributed to various circuits in the mainframe. If a 5-MHz input is used, A5A1 acts as a frequency doubler producing the 10-MHz required by the rest of the unit. The output of A5A1 is applied to all the other printed circuit boards in A5 (A5A2-A5A6). In A5A2, the 10-MHz signal is supplied to two amplifier and filter channels to provide two 10-MHz outputs. One output is applied to the RF plug-in section being used. The second output is supplied to an output connector at the rear of the frequency synthesizer to serve as a highly accurate 10-MHz reference signal. Board A5A3 is a 60-MHz generator. In A5A3, the 10-MHz signal is multiplied by 6, filtered, and the resultant 60-MHz output is supplied to 1 to 5 MHz comb generator A10A5 in the frequency extender.

6-6. The 65-MHz generator (A5A4) and 64-MHz generator (A5A5) generate the two comb line frequencies used in the mainframe. The 65-MHz generator multiplies the 10-MHz input by 13 and divides by 2 to produce the 65-MHz output. The 64-MHz generator multiplies the 10-MHz input by 8, divides the result by 5, and multiplies the 16-MHz result by 4 to produce the 64-MHz output. The 64- and 65-MHz output of A5A4 and A5A5, respectively, are both applied through A4 to all BCD sections.

6-7. The 10-MHz also is applied to 35/35.5 MHz board A5A6. In A5A6, the 10-MHz signal is multiplied by 7 and divided by 2, and the resultant 35-MHz signal is applied to the board output as well as to a divide-by-10 circuit within the board. The 64-MHz input to A5A6 (from A5A5) is mixed with the second harmonic of the divide-by-10 circuit (7 MHz) and bandpass filtered to produce a 71-MHz signal. This signal is divided by 2 to produce the 35.5-MHz output signal. A logic circuit on the card, which is controlled by the plug-in logic, determines whether the 35-MHz or 35.5-MHz signal will be available at the A5A6 output. This output provides the starting frequency for the BCD synthesis section.

6-8. The 35/35.5 MHz output of A5A6 is applied to lower order BCD board A2A5. With the -001 option, the A2A5 board produces the tenths of a Hertz output. When this option is not used, the A2A5 board is replaced by a jumper board and the tenths of a Hertz digit is not produced. The 35/35.5 MHz is applied through the jumper board to A2A4. The jumper board also transfers control of the 35/35.5 MHz logic to the 0.1 Hz logic line instead of the 0.05 Hz logic as it would be controlled with option -001. The 64 and 65 MHz comb line frequencies are also applied to the lower order BCD boards from A4A6 after being buffered on 10 kHz BCD board A4A11. These buffered comb line frequencies are applied directly to A2A1 and are further buffered and distributed from there to A2A2, A2A3, A2A4, and A2A5.

6-9. Selection of a frequency to be produced by the signal generator is set into the keyboard front panel A1A1. The frequency information is routed through the MPU assembly and into the plug-in section which contains a logic converter. The logic converter is in the plug-in section because each plug-in unit requires different logic signals depending upon the frequency range of the particular unit. The logic signals are returned to the frequency synthesizer mainframe through the plug-in module interface, J1 and J2, and are distributed by logic and power distribution board A14 to all BCD boards. Table 6-1 lists the signal name at each pin of the interface connector.

6-10. The logic signals representing the selected frequency output cause the lower order BCD boards to generate the lower order numbers. Board A2A5 generates the tenth of a Hertz digit (if -001 option is used); A2A4 generates the 1-Hz digit; A2A3 generates the 10-Hz digit, A2A2 generates the 100-Hz digit; and A2A1 generates the 1-kHz digit. Each digit is generated and added to the output of the BCD stage which feeds that particular stage thus forming a chain. (See paragraph 6-66 for a detailed description of how each BCD stage operates to produce its applicable digit). The output of A2A1 is applied to the higher order BCD assembly.

6-11. The higher order BCD assembly selects the 10-kHz and 100-kHz digits in the frequency synthesizer output. A4A11 generates the 10-kHz steps and A4A1-A4A10 produce the 100-kHz step. A4A1 through A4A4 are driven by 64/65 MHz switches A4A7 through A4A10, respectively. The BCD-8 #2 board (A4A5) functions as a final divider, filter, and amplifier for the selected frequency synthesizer mainframe output.

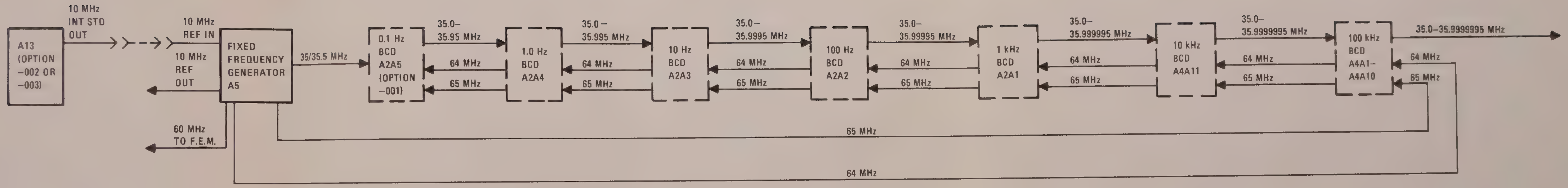


Figure 6-1. Synthesized Signal Generator Mainframe, Functional Block Diagram

TABLE 6-1. PLUG-IN/MAINFRAME INTERFACE (PMI) WIRE LIST

From	To	Signal Name
J1-A	A14 J6-16	BCD 1 kHz-1
J1-B	A1/A1 J1-13	Loc 100 kHz-2
J1-C	A5 J2	10 MHz (Coax)
J1-D	A1/A1 J1-26	Loc 100 kHz-8
J1-E	A14 J6-4	BCD 1 kHz-8
J1-F	A1/A1 J1-12	Loc 100 kHz-4
J1-H	A14 J6-18	BCD 1 kHz-2
J1-J	A1/A1 J1-25	Loc 100 kHz-1
J1-K	A14 J6-15	BCD 1 kHz-4
J1-L	A1/A1 J1-11	Loc 1 MHz-4
J1-M	A14 J6-1	BCD 100 Hz-2
J1-N	A1/A1 J1-24	Loc 1 MHz-2
J1-P	A14 J6-3	BCD 100 Hz-4
J1-R	A1/A1 J1-10	Loc 1 MHz-8
J1-S	A14 J6-9	BCD 1.0 Hz-1
J1-T	A1/A1 J1-23	Loc 1 MHz-1
J1-U	A14 J6-11	BCD 1.0 Hz-8
J1-V	A1/A1 J1-9	Loc 10 MHz-4
J1-W	A14 J6-10	BCD 1.0 Hz-2
J1-X	A1/A1 J1-22	Loc 10 MHz-2
J1-Y	A14 J6-12	BCD 1.0 Hz-4
J1-Z	A1/A1 J1-8	Loc 10 MHz-8
J1-AA	A1/A1 J1-15	Loc 100 Hz-4
J1-BB	A14 J6-22	FEM 1 MHz-2
J1-CC	A1/A1 J1-2	Loc 100 Hz-1
J1-DD	A14 J6-19	FEM 1 MHz-8
J1-EE	A1/A1 J1-14	Loc 100 Hz-2
J1-FF	A14 J6-23	FEM 1 MHz-1
J1-HH	A1/A1 J1-1	Loc 100 Hz-8
J1-a	A14 J6-24	BCD 0.1 Hz-8
J1-b	A1/A1 J1-21	Loc 10 MHz-1
J1-c	A14 J6-25	BCD 0.1 Hz-4
J1-d	A1/A1 J1-7	Loc 1 kHz-4

TABLE 6-1. PLUG-IN/MAINFRAME INTERFACE (PMI) WIRE LIST (Cont)

From	To	Signal Name
J1-e	A14 J6-5	BCD 10 Hz-1
J1-f	A1/A1 J1-20	Loc 1 kHz-2
J1-h	A14 J6-26	BCD 0.1 Hz-2
J1-j	A1/A1 J1-6	Loc 1 kHz-1
J1-k	A14 J6-20	BCD 10 Hz-8
J1-m	A1/A1 J1-19	Loc 1 kHz-8
J1-n	A14 J6-13	BCD 0.1 Hz-1
J1-p	A1/A1 J1-5	Loc 1.0 Hz-4
J1-r	A14 J6-7	BCD 10-Hz-4
J1-s	A1/A1 J1-18	Loc 1.0 Hz-2
J1-t	A14 J6-6	BCD 10 Hz-2
J1-u	A1/A1 J1-4	Loc 1.0 Hz-8
J1-v	A14 J6-14	BCD 100 Hz-1
J1-w	A1/A1 J1-17	Loc 1.0 Hz-1
J1-x	A14 J6-2	BCD 100 Hz-8
J1-y	A14 J6-8	0.05 Hz Log
J1-z	A14 J6-21	FEM 1 MHz-4
J2-A	Chassis Gnd	Gnd
J2-B	A14 J3-6	5.2V
J2-C	A10 J5	30/40 MHz (coax)
J2-D	A14 J3-7	5.2V
J2-E	A14 J3-5	5.2V
J2-F	A1/A1 J2-13	Loc 0.1 Hz-8
J2-H	A10 J10	29 MHz (coax)
J2-J	A1/A1 J2-26	Loc 10 Hz-4
J2-K	A14 J5-1	BCD 10 kHz-8
J2-L	A1/A1 J2-12	Loc 0.1 Hz-4
J2-M	A7 J2	29 MHz (coax)
J2-N	A1/A1 J2-25	Loc 10 Hz-8
J2-P	A14 J5-6	BCD 10 kHz-1
J2-R	A1/A1 J2-11	Loc 0.1 Hz-2
J2-S	A14 J5-3	BCD 10 kHz-2
J2-T	A1/A1 J2-24	Loc 10 Hz-2
J2-U	A14 J5-2	BCD 10 kHz-4

TABLE 6-1. PLUG-IN/MAINFRAME INTERFACE (PMI) WIRE LIST (Cont)

From	To	Signal Name
J2-V	A1/A1 J2-10	Loc 0.1 Hz-1
J2-W	Not Used	
J2-X	A1/A1 J2-23	Loc 10 Hz-1
J2-Y	A14 J5-4	RESLT2
J2-Z	A1/A1 J2-9	Loc 100 MHz-4
J2-AA	A1/A1-J2-17	Loc 10 kHz-8
J2-BB	A14 J3-1	-12 VOP
J2-CC	A1/A1 J2-4	Loc 10 kHz-2
J2-DD	A14 J3-9	-12 VOP
J2-EE	A14 J3-4	5.2V
J2-FF	A14 J3-2	-12 VOP
J2-HH	A14 J5-24	Loc/Rem
J2-a	Not Used	
J2-b	A1/A1 J2-22	Loc 100 MHz-2
J2-c	A14 J5-5	RESLT1
J2-d	A14 J5-11	Loc/Rem
J2-e	A14 J5-10	BCD 100 kHz-1
J2-f	A1/A1 J2-21	Loc 100 MHz-8
J2-h	A14 J5-7	BCD 100 kHz-8
J2-j	A1/A1 J2-8	Loc 100 MHz-1
J2-k	A14 J5-9	BCD 100 kHz-2
J2-m	A1/A1 J2-20	Loc 1 GHz-4
J2-n	A14 J5-8	BCD 100 kHz-4
J2-p	A1/A1 J2-7	Loc 1 GHz-2
J2-r	Not Used	
J2-s	A1/A1 J2-19	Loc 1 GHz-8
J2-t	Not Used	
J2-u	A1/A1 J2-6	Loc 1 GHz-1
J2-v	Not Used	
J2-w	A1/A1 J2-18	Loc 10 kHz-1
J2-x	Not Used	
J2-y	A1/A1 J2-5	Loc 10 kHz-4
J2-z	Not Used	

6-12. FREQUENCY EXTENDER. (Figure 6-2)

6-13. The purpose of the frequency extender is to add 1-MHz steps to the 35- to 36-MHz output of the frequency synthesizer mainframe, to extend the output to cover a 30- to 40-MHz output for use by certain plug-in units. The principle of drift cancellation is used to accomplish this extension.

6-14. Logic inputs to 24 to 33 MHz oscillator A6 control the frequency generated by A6. One output of A6 is applied to 29 MHz converter A10A6. The same logic which selects the A6 output also is applied to 1 to 5 MHz comb generator A10A5. This logic selects a comb line frequency between 1 and 5 MHz, which when mixed with the A6 output, results in a constant 29-MHz output from 29-MHz converter A10A6. The 1 to 5 MHz comb lines are developed from a 60-MHz input to A10A5 using a programmable counter technique. The 60-MHz input comes from 60-MHz generator A5A3 in the mainframe.

6-15. Another output of A6 is mixed in A10A2 with a 337-MHz signal from 337 MHz oscillator/isolator A10A1 to produce a 361- to 370-MHz output. This output is amplified and band-pass filtered in 361 to 370 MHz filter amplifier A8 and applied to a frequency converter on A10A4.

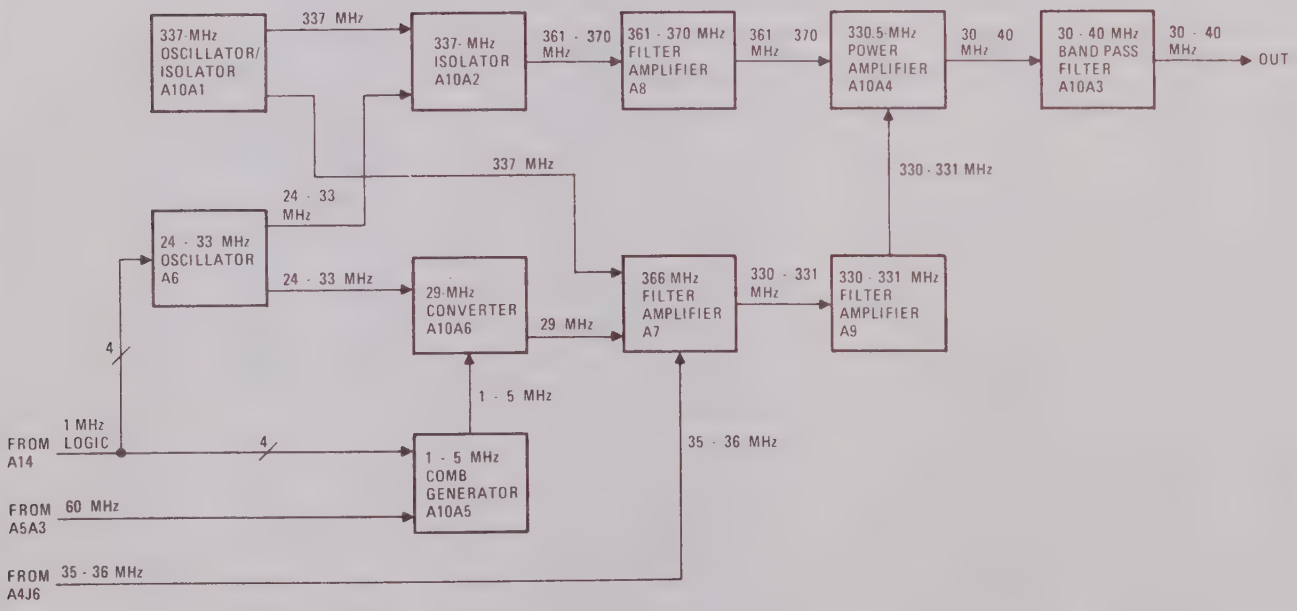

337-MHz OSCILLATOR/ ISOLATOR A10A1
337 MHz
337- MHz ISOLATOR A10A2
361 - 370 MHz
361 - 370 MHz FILTER AMPLIFIER A8
361 370 MHz
330.5-MHz POWER AMPLIFIER A10A4
30 40 MHz
30 - 40 MHz BAND PASS FILTER A10A3
30 - 40 MHz
OUT
337 MHz
330 - 331 MHz
24 - 33 MHz
24 - 33 MHz OSCILLATOR A6
24 - 33 MHz
29-MHz CONVERTER A10A6
29 MHz
366 MHz FILTER AMPLIFIER A7
330 - 331 MHz
330 - 331 MHz FILTER AMPLIFIER A9
4
1 - 5 MHz
35 - 36 MHz
FROM A14
1 MHz LOGIC
4
1 - 5 MHz COMB GENERATOR A10A5
FROM A5A3
60 MHz
FROM A4J6
35 - 36 MHz

Figure 6-2. Frequency Extender, Functional Block Diagram

6-16. A second 337-MHz output of A10A1 is applied to 366 MHz filter amplifier A7 and mixed with the 29-MHz input from A10A6 to produce a 366-MHz signal. After band-pass filtering, the 366-MHz signal is mixed with the 35- to 36-MHz signal from the mainframe to produce a signal between 330 and 331 MHz. This signal is band-pass filtered in 330 to 331 MHz filter amplifier A9 and applied to 330.5 MHz power amplifier A10A4.

6-17. In 330.5 MHz power amplifier A10A4, the 330- to 331-MHz output of A9 is amplified and mixed with the 361 to 370 MHz output of A8 to produce a frequency between 30 and 40 MHz. This 30- to 40-MHz output is band-pass filtered in 30 to 40 MHz band-pass filter A10A3 before being applied to the plug-in unit being used.

6-18. The Drift Cancellation principle can be illustrated by observing what happens if the 24-33 MHz oscillator is deviated from its nominal value by a frequency error Δ f. For the case where 30.000000 MHz is selected, a logic 0 is programmed to the frequency extender module. The 24-33 MHz oscillator should be at 24 MHz and the 1-5 MHz comb generator is at 5 MHz. The frequency in the 361-370 MHz filter will then be Δf higher than 361 MHz. At the same time, however, the 29 MHz signal in A10A6 will be Δf high causing the 366 MHz signal in A7 to high by Δf also. This causes the 330 MHz signal to be high by Δf, but this signal is subtracted from the 361 x Δf MHz signal in A10A4. The net result is (361 + ΔF) - (330 + Δf) = 30 MHz which is exactly what was selected. Therefore any drift of the 24-33 MHz oscillator is cancelled by this technique.

6-19. TROUBLESHOOTING

6-20. **SYNTHESIZED SIGNAL GENERATOR MAINFRAME.** Figure 6-3 is a troubleshooting chart for the signal generator mainframe. Through use of the chart and the servicing block diagram (Figure 6-4) a malfunction can be isolated to a board or subassembly. Figure 6-5 provides an interconnection diagram for the digital subsystem. Figure 6-6 shows the location of all boards and subassemblies in the mainframe. To further isolate a malfunction to a defective component on a board or subassembly see the applicable paragraph on repair of the board or subassembly.

6-21. **FREQUENCY EXTENDER.** The troubleshooting procedure philosophy for the frequency extender is the same as that for the mainframe as described in paragraph 6-20. Figure 6-7 is the troubleshooting chart, figure 6-8 is the servicing block diagram, and figure 6-9 shows the location of boards and subassemblies in the frequency extender.

6-22. REPAIR

6-23. The following paragraphs provide repair data for boards and subassemblies of the frequency synthesizer mainframe. (Repair data for the frequency extender is given in paragraphs 6-207 through 6-244.) The data is presented in the form of functional description (with significant circuit parameters), schematic diagrams, parts location diagrams, and references to the servicing block diagrams, replaceable parts list, and recommended test equipment to be used (Table 1-5). With all of the data presented, an experienced technician should be able to isolate a malfunction to a component on a board or subassembly with the board or subassembly either in the frequency synthesizer (normal system signals being used) or on a bench (simulated signals being used). To further aid in understanding the functional descriptions presented in the following paragraphs, figure 6-10 is provided to show the internal structure of all integrated circuits used in the signal generator.

6-24. Repair data for each printed circuit board can be found on the servicing block diagram, the referenced schematic diagrams, and in the functional descriptions. To facilitate identification of parts, component location diagrams are included for each printed circuit card. A description of each component is given in Chapter 7.

6-25. FRONT PANEL ASSEMBLY A1. (Figure 6-11)

6-26. The front panel assembly contains the keyboard assembly A1A1, encoder board assembly A1A2 and optical encoder A1A3.

6-27. KEYBOARD ASSEMBLY A1A1. (Figure 6-12 through 6-15). The keyboard contains 35 key switches, 11 numeric displays, 29 LEDs, 4 octal latches and 2 resistor networks. This board serves as the human interface to the 380 Synthesized Signal Generator.

6-28. Keyswitch Arrays. The 35 keyswitches are organized into two arrays, A and B. All switches are single-pole, single-throw, momentary action mechanical switches.

6-29. Numeric Indicators (U1-U11). The numeric indicators have on-board decoder/driver and memory within each display package.

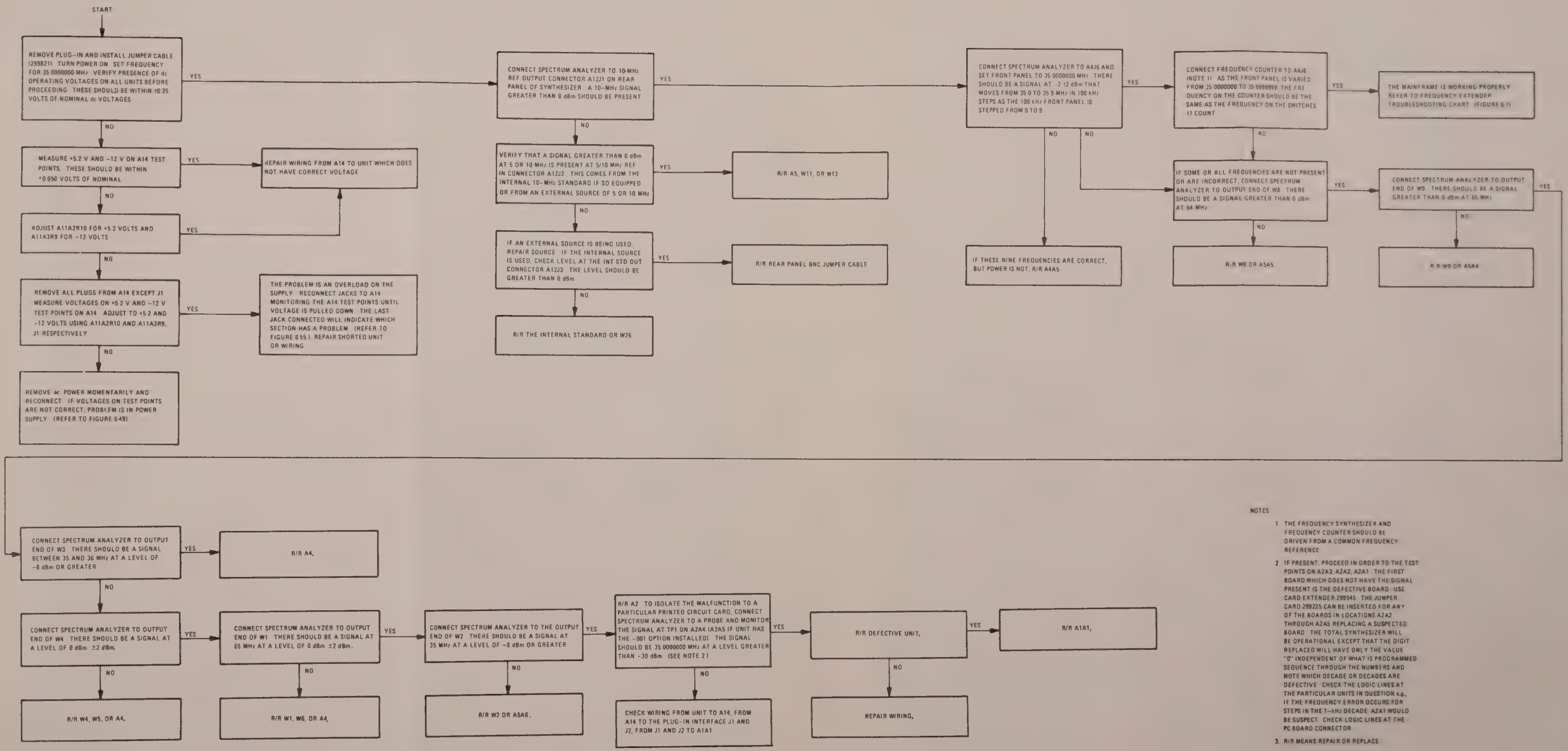
6-30. The numeric indicator decodes positive 8421 BCD logic inputs into characters 0-9, a minus sign, a test pattern, and four blanks in the invalid BCD states. The unit employs a left-hand decimal point which is turned on by a V_{IL} when the indicator is enabled.

6-31. The indicators are wired in a bit parallel, character serial configuration. The five data inputs of each display are parallel wired to the buffered data bus lines (DX0 through DX4). The latch enable input of each display is wired to an output (DSP-00 through DSP-10) on one of the two address decoders located on the encoder board. When the latch enable input is driven low, the numeric indicator will display the decoded BCD inputs and decimal point if enabled. When the latch enable returns to a logic high, the input data will become latched and displayed continuously until changed again.

6-32. LED Latches. The four octal latches U15, 16, 17, 12 store the required states of the various LEDs. These latches have their data inputs parallel wired to the DX0 through DX7 signals and the clock input of each latch is wired to one of the address decoder outputs (DSP-11, DSP-13, DSP-14 or DSP-15).

6-33. The output control input of each latch is wired to ground for continuous operation. On the rising edge of the clock input, the logic levels at the data inputs get latched at the output and drive the appropriate LEDs. The outputs of each latch are connected to the cathodes of the LED indicators. These outputs are capable of sinking 25 mA, which is sufficient to drive the LED without additional drivers.

6-34. The anodes of each LED are wired to a 330 ohm resistor. These resistors are in resistor network packages (U13 and U14). The other end of each resistor is internally tied to a common pin, and externally tied to VCC. This provides the proper current limiting for each LED.


START
REMOVE PLUG-IN AND INSTALL JUMPER CABLE (299821) TURN POWER ON SET FREQUENCY FOR 35 0000000 MHz VERIFY PRESENCE OF dc OPERATING VOLTAGES ON ALL UNITS BEFORE PROCEEDING THESE SHOULD BE WITHIN ±0 25 VOLTS OF NOMINAL dc VOLTAGES
YES
NO
MEASURE +5.2 V AND −12 V ON A14 TEST POINTS. THESE SHOULD BE WITHIN +0 050 VOLTS OF NOMINAL
REPAIR WIRING FROM A14 TO UNIT WHICH DOES NOT HAVE CORRECT VOLTAGE
ADJUST A11A2R10 FOR +5.2 VOLTS AND A11A3R9 FOR −12 VOLTS
REMOVE ALL PLUGS FROM A14 EXCEPT J1 MEASURE VOLTAGES ON +5 2 V AND −12 V TEST POINTS ON A14 ADJUST TO +5 2 AND −12 VOLTS USING A11A2R10 AND A11A3R9, J1 RESPECTIVELY
THE PROBLEM IS AN OVERLOAD ON THE SUPPLY RECONNECT JACKS TO A14 MONITORING THE A14 TEST POINTS UNTIL VOLTAGE IS PULLED DOWN THE LAST JACK CONNECTED WILL INDICATE WHICH SECTION HAS A PROBLEM (REFER TO FIGURE 6 55) REPAIR SHORTED UNIT OR WIRING
REMOVE ac POWER MOMENTARILY AND RECONNECT IF VOLTAGES ON TEST POINTS ARE NOT CORRECT, PROBLEM IS IN POWER SUPPLY (REFER TO FIGURE 6-49)
CONNECT SPECTRUM ANALYZER TO 10-MHz REF OUTPUT CONNECTOR A12J1 ON REAR PANEL OF SYNTHESIZER A 10-MHz SIGNAL GREATER THAN 0 dBm SHOULD BE PRESENT
VERIFY THAT A SIGNAL GREATER THAN 0 dBm AT 5 OR 10 MHz IS PRESENT AT 5/10 MHz REF IN CONNECTOR A12J2 THIS COMES FROM THE INTERNAL 10-MHz STANDARD IF SO EQUIPPED OR FROM AN EXTERNAL SOURCE OF 5 OR 10 MHz
R/R A5, W11, OR W13
IF AN EXTERNAL SOURCE IS BEING USED, REPAIR SOURCE IF THE INTERNAL SOURCE IS USED, CHECK LEVEL AT THE INT STD OUT CONNECTOR A12J3 THE LEVEL SHOULD BE GREATER THAN 0 dBm
R/R REAR PANEL BNC JUMPER CABLE
R/R THE INTERNAL STANDARD OR W26
CONNECT SPECTRUM ANALYZER TO A4J6 AND SET FRONT PANEL TO 35 0000000 MHz THERE SHOULD BE A SIGNAL AT −2 ±2 dBm THAT MOVES FROM 35 0 TO 35 9 MHz IN 100 kHz STEPS AS THE 100 kHz FRONT PANEL IS STEPPED FROM 0 TO 9
IF THESE NINE FREQUENCIES ARE CORRECT, BUT POWER IS NOT, R/R A4A5
CONNECT FREQUENCY COUNTER TO A4J6 (NOTE 1) AS THE FRONT PANEL IS VARIED FROM 35 0000000 TO 35 9999999 THE FREQUENCY ON THE COUNTER SHOULD BE THE SAME AS THE FREQUENCY ON THE SWITCHES ±1 COUNT
THE MAINFRAME IS WORKING PROPERLY REFER TO FREQUENCY EXTENDER TROUBLESHOOTING CHART (FIGURE 6 7)
IF SOME OR ALL FREQUENCIES ARE NOT PRESENT OR ARE INCORRECT, CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W8 THERE SHOULD BE A SIGNAL GREATER THAN 0 dBm AT 64 MHz
R/R W8 OR A5A5
CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W9 THERE SHOULD BE A SIGNAL GREATER THAN 0 dBm AT 65 MHz
R R W9 OR A5A4
CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W3 THERE SHOULD BE A SIGNAL BETWEEN 35 AND 36 MHz AT A LEVEL OF −8 dBm OR GREATER
R/R A4.
CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W4 THERE SHOULD BE A SIGNAL AT A LEVEL OF 0 dBm ±2 dBm.
R/R W4, W5, OR A4.
CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W1 THERE SHOULD BE A SIGNAL AT 65 MHz AT A LEVEL OF 0 dBm ±2 dBm.
R/R W1, W6, OR A4.
CONNECT SPECTRUM ANALYZER TO THE OUTPUT END OF W2 THERE SHOULD BE A SIGNAL AT 35 MHz AT A LEVEL OF −6 dBm OR GREATER
R/R W2 OR A5A6.
R/R A2 TO ISOLATE THE MALFUNCTION TO A PARTICULAR PRINTED CIRCUIT CARD, CONNECT SPECTRUM ANALYZER TO A PROBE AND MONITOR THE SIGNAL AT TP1 ON A2A4 (A2A5 IF UNIT HAS THE −001 OPTION INSTALLED) THE SIGNAL SHOULD BE 35 0000000 MHz AT A LEVEL GREATER THAN −30 dBm (SEE NOTE 2)
CHECK WIRING FROM UNIT TO A14, FROM A14 TO THE PLUG-IN INTERFACE J1 AND J2, FROM J1 AND J2 TO A1A1
R/R DEFECTIVE UNIT.
REPAIR WIRING.
R/R A1A1.

NOTES

1 THE FREQUENCY SYNTHESIZER AND FREQUENCY COUNTER SHOULD BE DRIVEN FROM A COMMON FREQUENCY REFERENCE

2 IF PRESENT, PROCEED IN ORDER TO THE TEST POINTS ON A2A3, A2A2, A2A1 THE FIRST BOARD WHICH DOES NOT HAVE THE SIGNAL PRESENT IS THE DEFECTIVE BOARD USE CARD EXTENDER 299545 THE JUMPER CARD 299225 CAN BE INSERTED FOR ANY OF THE BOARDS IN LOCATIONS A2A2 THROUGH A2A5 REPLACING A SUSPECTED BOARD THE TOTAL SYNTHESIZER WILL BE OPERATIONAL EXCEPT THAT THE DIGIT REPLACED WILL HAVE ONLY THE VALUE "0" INDEPENDENT OF WHAT IS PROGRAMMED SEQUENCE THROUGH THE NUMBERS AND NOTE WHICH DECADE OR DECADES ARE DEFECTIVE CHECK THE LOGIC LINES AT THE PARTICULAR UNITS IN QUESTION e.g. IF THE FREQUENCY ERROR OCCURS FOR STEPS IN THE 1-kHz DECADE A2A1 WOULD BE SUSPECT CHECK LOGIC LINES AT THE PC BOARD CONNECTOR

3. R/R MEANS REPAIR OR REPLACE

Figure 6-3. Frequency Synthesizer Mainframe, Troubleshooting Chart

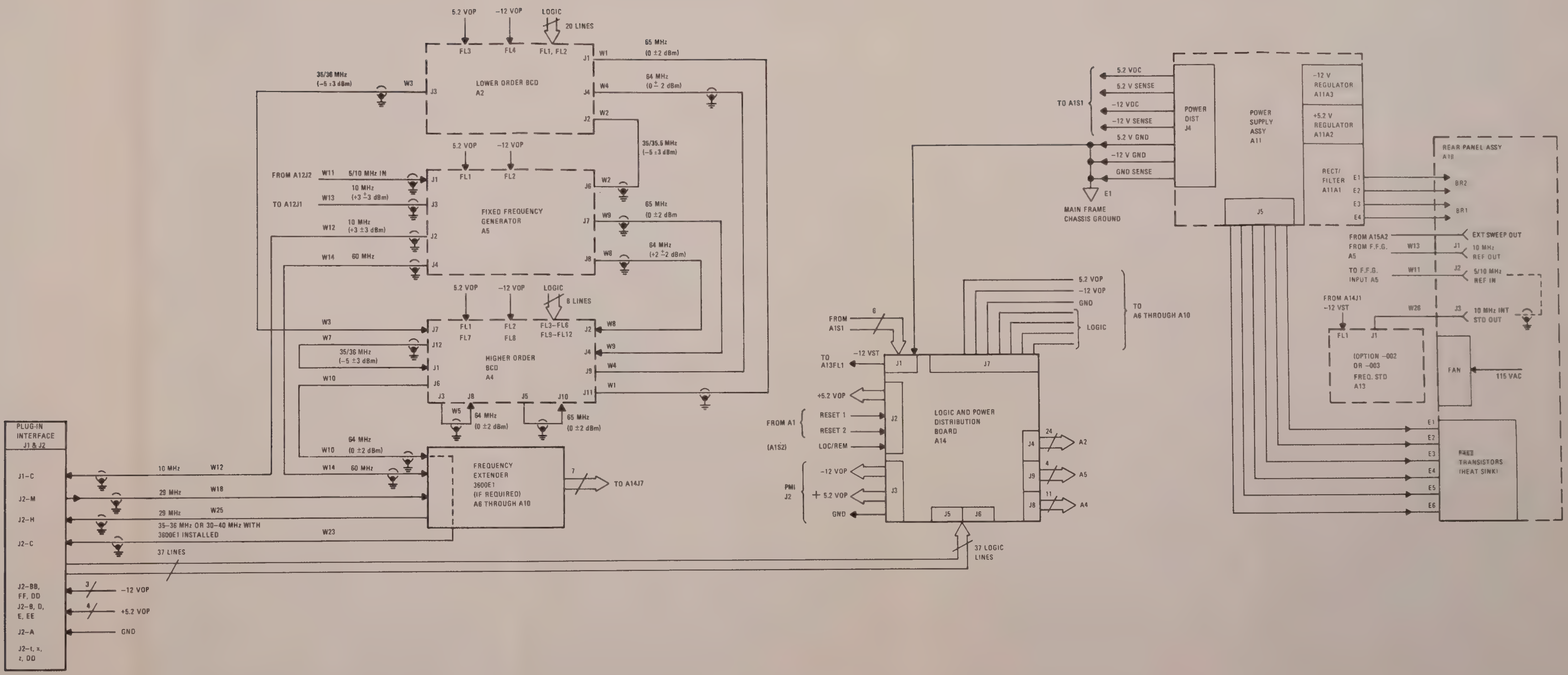


Figure 6-4. Frequency Synthesizer Mainframe, Servicing Block Diagram

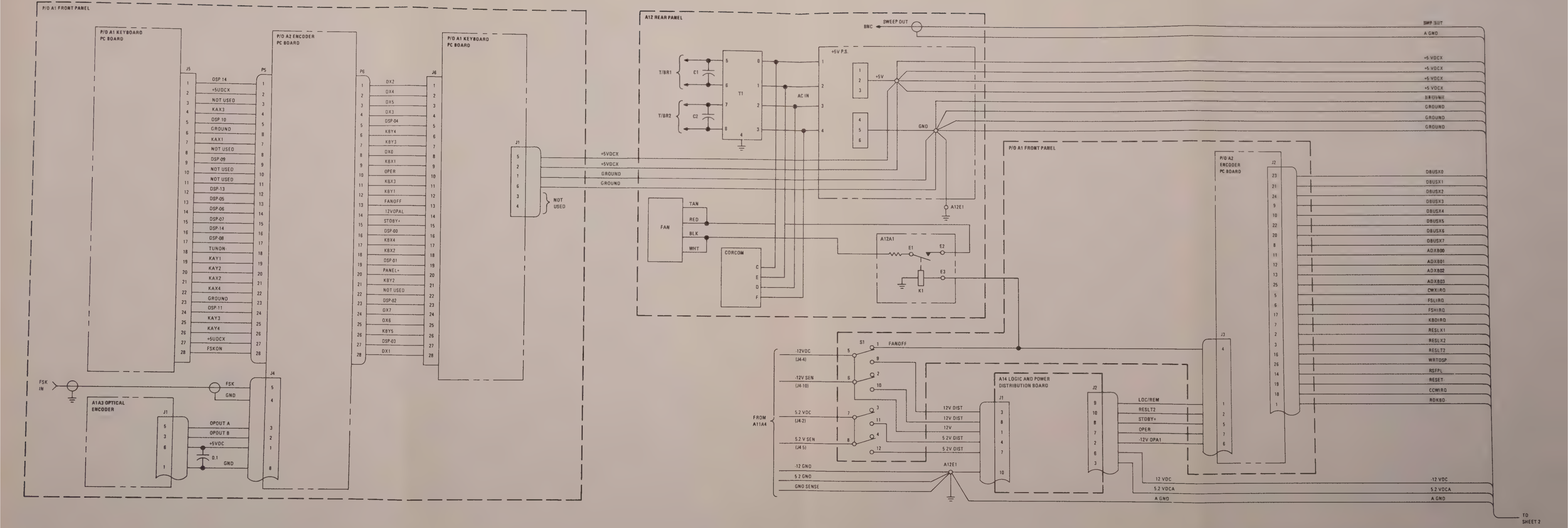


Figure 6-5. Digital Subsystem Interconnection Diagram (Sheet 1)

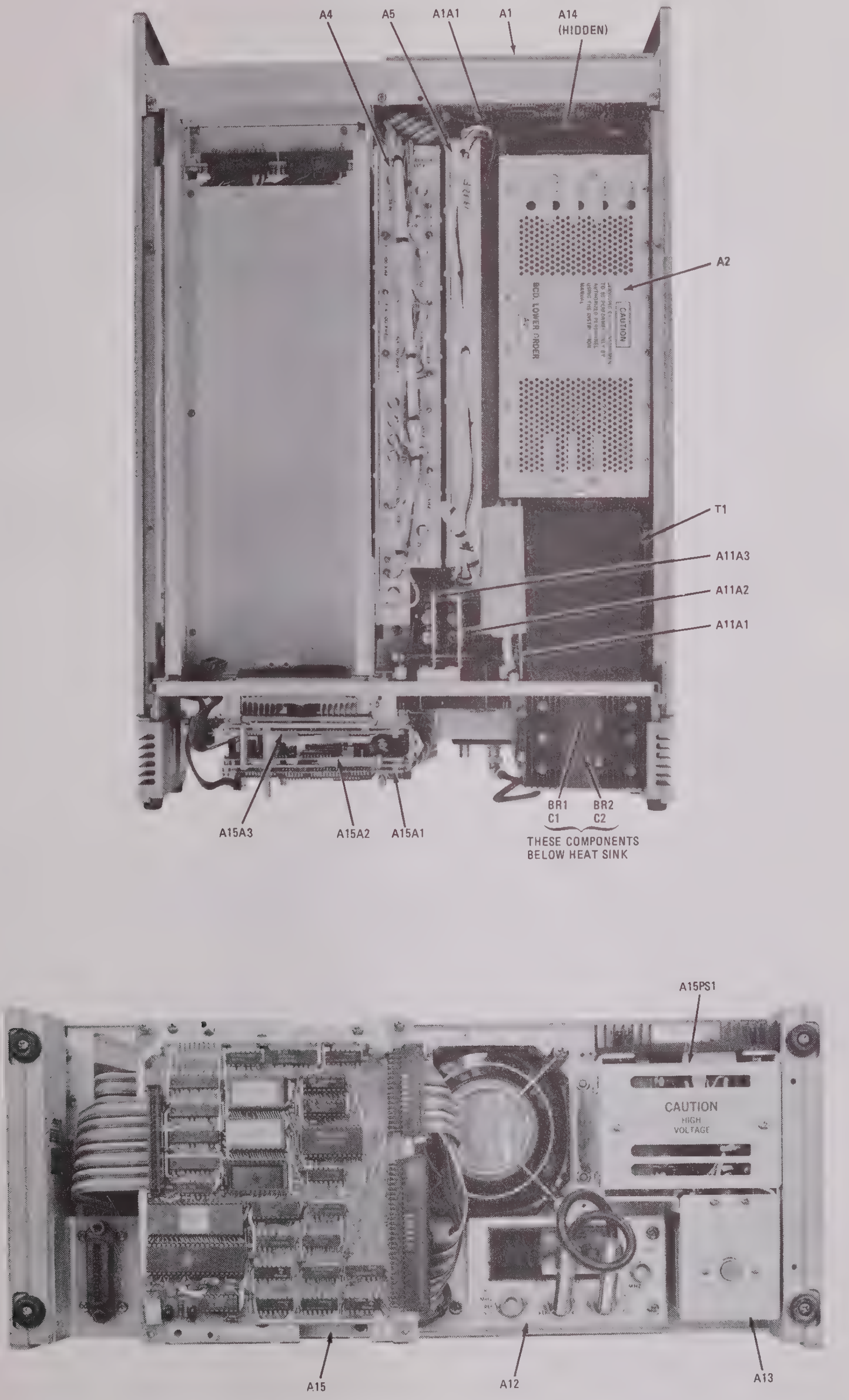
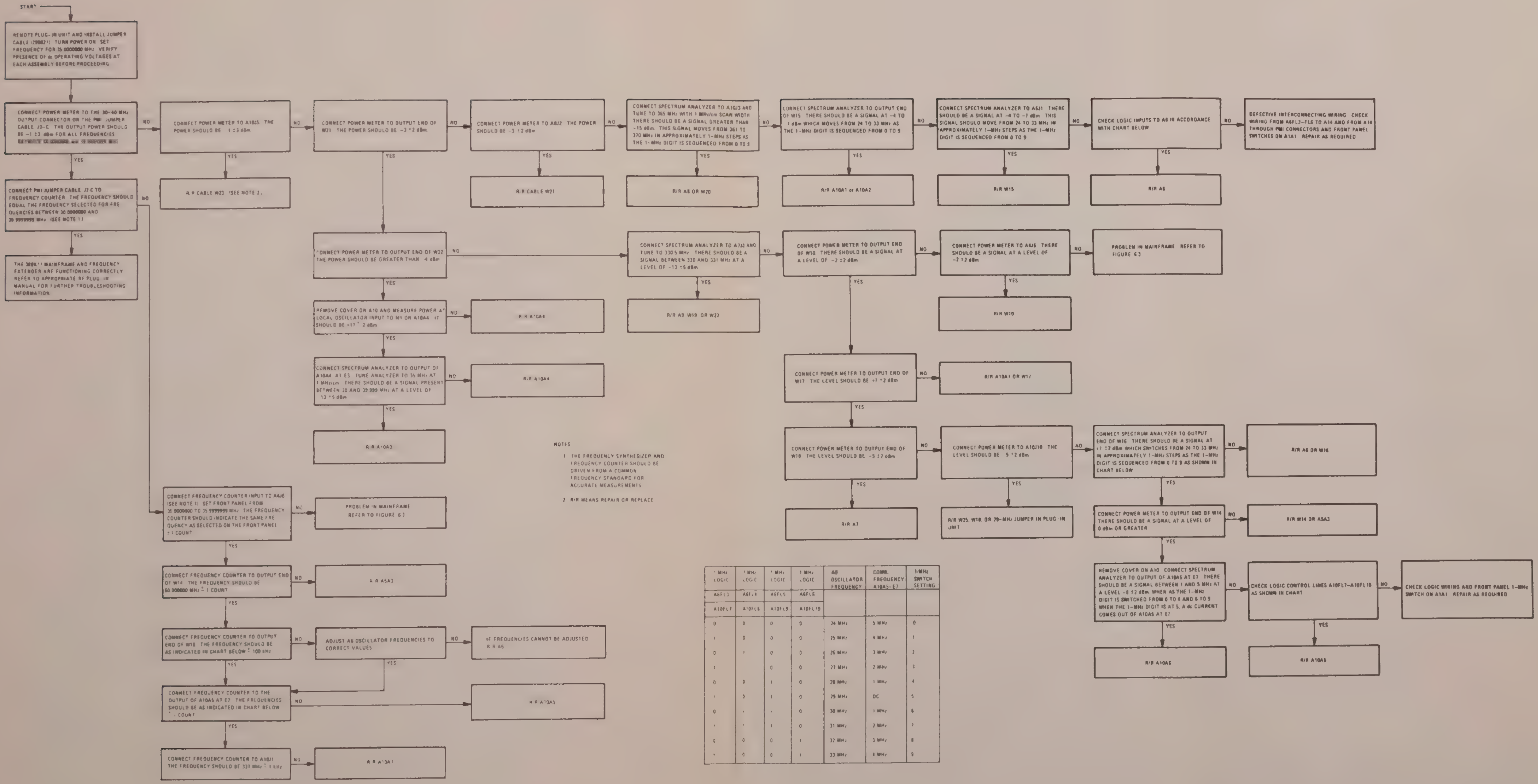


Figure 6-6. Frequency Synthesizer Mainframe, Subassembly Locations


START
REMOTE PLUG-IN UNIT AND INSTALL JUMPER CABLE (299821) TURN POWER ON SET FREQUENCY FOR 35.0000000 MHz VERIFY PRESENCE OF dc OPERATING VOLTAGES AT EACH ASSEMBLY BEFORE PROCEEDING
CONNECT POWER METER TO THE 30–40 MHz OUTPUT CONNECTOR ON THE PMI JUMPER CABLE J2–C THE OUTPUT POWER SHOULD BE –1 ±3 dBm FOR ALL FREQUENCIES [redacted]
NO
CONNECT POWER METER TO A10J5 THE POWER SHOULD BE 1 ±3 dBm
NO
CONNECT POWER METER TO OUTPUT END OF W21 THE POWER SHOULD BE –3 ±2 dBm
NO
CONNECT POWER METER TO A8J2 THE POWER SHOULD BE –3 ±2 dBm
NO
CONNECT SPECTRUM ANALYZER TO A10J3 AND TUNE TO 365 MHz WITH 1 MHz/cm SCAN WIDTH THERE SHOULD BE A SIGNAL GREATER THAN –15 dBm. THIS SIGNAL MOVES FROM 361 TO 370 MHz IN APPROXIMATELY 1–MHz STEPS AS THE 1–MHz DIGIT IS SEQUENCED FROM 0 TO 9
NO
CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W15 THERE SHOULD BE A SIGNAL AT –4 TO 7 dBm WHICH MOVES FROM 24 TO 33 MHz AS THE 1-MHz DIGIT IS SEQUENCED FROM 0 TO 9
NO
CONNECT SPECTRUM ANALYZER TO A6J1 THERE SHOULD BE A SIGNAL AT –4 TO –7 dBm THIS SIGNAL SHOULD MOVE FROM 24 TO 33 MHz IN APPROXIMATELY 1–MHz STEPS AS THE 1–MHz DIGIT IS SEQUENCED FROM 0 TO 9
NO
CHECK LOGIC INPUTS TO A6 IN ACCORDANCE WITH CHART BELOW
NO
DEFECTIVE INTERCONNECTING WIRING CHECK WIRING FROM A6FL3–FL6 TO A14 AND FROM A14 THROUGH PMI CONNECTORS AND FRONT PANEL SWITCHES ON A1A1 REPAIR AS REQUIRED
YES
R/R CABLE W23 (SEE NOTE 2.)
YES
R/R CABLE W21
YES
R/R A8 OR W20
YES
R/R A10A1 or A10A2
YES
R/R W15
YES
R/R A6
YES
CONNECT PMI JUMPER CABLE J2 C TO FREQUENCY COUNTER THE FREQUENCY SHOULD EQUAL THE FREQUENCY SELECTED FOR FREQUENCIES BETWEEN 30.0000000 AND 39.9999999 MHz (SEE NOTE 1.)
NO
YES
THE 380K11 MAINFRAME AND FREQUENCY EXTENDER ARE FUNCTIONING CORRECTLY REFER TO APPROPRIATE RF PLUG IN MANUAL FOR FURTHER TROUBLESHOOTING INFORMATION
YES
CONNECT POWER METER TO OUTPUT END OF W22 THE POWER SHOULD BE GREATER THAN –4 dBm
NO
CONNECT SPECTRUM ANALYZER TO A7J3 AND TUNE TO 330.5 MHz THERE SHOULD BE A SIGNAL BETWEEN 330 AND 331 MHz AT A LEVEL OF –13 ±5 dBm
NO
CONNECT POWER METER TO OUTPUT END OF W10 THERE SHOULD BE A SIGNAL AT A LEVEL OF –2 ±2 dBm
NO
CONNECT POWER METER TO A4J6 THERE SHOULD BE A SIGNAL AT A LEVEL OF –2 ±2 dBm
NO
PROBLEM IN MAINFRAME REFER TO FIGURE 6.3
YES
R/R A9 W19 OR W22
YES
R/R W10
YES
REMOVE COVER ON A10 AND MEASURE POWER AT LOCAL OSCILLATOR INPUT TO M1 ON A10A4 IT SHOULD BE +17 ± 2 dBm
NO
R/R A10A4
YES
CONNECT SPECTRUM ANALYZER TO OUTPUT OF A10A4 AT E3 TUNE ANALYZER TO 35 MHz AT 1 MHz/cm THERE SHOULD BE A SIGNAL PRESENT BETWEEN 30 AND 39.999 MHz AT A LEVEL OF 13 ±5 dBm
NO
R/R A10A4
YES
R/R A10A3
YES
CONNECT POWER METER TO OUTPUT END OF W17 THE LEVEL SHOULD BE +7 ±2 dBm
NO
R/R A10A1 OR W17
YES
CONNECT POWER METER TO OUTPUT END OF W18 THE LEVEL SHOULD BE –5 ±2 dBm
NO
CONNECT POWER METER TO A10J10 THE LEVEL SHOULD BE 5 ±2 dBm
NO
CONNECT SPECTRUM ANALYZER TO OUTPUT END OF W16 THERE SHOULD BE A SIGNAL AT +7 ±2 dBm WHICH SWITCHES FROM 24 TO 33 MHz IN APPROXIMATELY 1–MHz STEPS AS THE 1–MHz DIGIT IS SEQUENCED FROM 0 TO 9 AS SHOWN IN CHART BELOW
NO
R/R A6 OR W16
YES
R/R A7
YES
R/R W25, W18, OR 29–MHz JUMPER IN PLUG IN UNIT
YES
CONNECT POWER METER TO OUTPUT END OF W14 THERE SHOULD BE A SIGNAL AT A LEVEL OF 0 dBm OR GREATER
NO
R/R W14 OR A5A3
YES
REMOVE COVER ON A10 CONNECT SPECTRUM ANALYZER TO OUTPUT OF A10A5 AT E7 THERE SHOULD BE A SIGNAL BETWEEN 1 AND 5 MHz AT A LEVEL –8 ±2 dBm WHEN AS THE 1–MHz DIGIT IS SWITCHED FROM 0 TO 4 AND 6 TO 9 WHEN THE 1–MHz DIGIT IS AT 5, A dc CURRENT COMES OUT OF A10A5 AT E7
NO
CHECK LOGIC CONTROL LINES A10FL7–A10FL10 AS SHOWN IN CHART
NO
CHECK LOGIC WIRING AND FRONT PANEL 1–MHz SWITCH ON A1A1 REPAIR AS REQUIRED
YES
R/R A10A6
YES
R/R A10A5
CONNECT FREQUENCY COUNTER INPUT TO A4J6 (SEE NOTE 1) SET FRONT PANEL FROM 35.0000000 TO 35.9999999 MHz THE FREQUENCY COUNTER SHOULD INDICATE THE SAME FREQUENCY AS SELECTED ON THE FRONT PANEL ±1 COUNT
NO
PROBLEM IN MAINFRAME REFER TO FIGURE 6.3
YES
CONNECT FREQUENCY COUNTER TO OUTPUT END OF W14 THE FREQUENCY SHOULD BE 60.000000 MHz ± 1 COUNT
NO
R/R A5A3
YES
CONNECT FREQUENCY COUNTER TO OUTPUT END OF W16 THE FREQUENCY SHOULD BE AS INDICATED IN CHART BELOW ± 100 kHz
NO
ADJUST A6 OSCILLATOR FREQUENCIES TO CORRECT VALUES
NO
IF FREQUENCIES CANNOT BE ADJUSTED R/R A6
YES
YES
CONNECT FREQUENCY COUNTER TO THE OUTPUT OF A10A5 AT E7 THE FREQUENCIES SHOULD BE AS INDICATED IN CHART BELOW ± 1 COUNT
NO
R/R A10A5
YES
CONNECT FREQUENCY COUNTER TO A10J1 THE FREQUENCY SHOULD BE 337 MHz ± 1 kHz
NO
R/R A10A1

NOTES

1. THE FREQUENCY SYNTHESIZER AND FREQUENCY COUNTER SHOULD BE DRIVEN FROM A COMMON FREQUENCY STANDARD FOR ACCURATE MEASUREMENTS
2. R/R MEANS REPAIR OR REPLACE

1 MHz LOGIC	1 MHz LOGIC	1 MHz LOGIC	1 MHz LOGIC	A6 OSCILLATOR FREQUENCY	COMB. FREQUENCY A10A5–E7	1-MHz SWITCH SETTING
A6FL3	A6FL4	A6FL5	A6FL6			
A10FL7	A10FL8	A10FL9	A10FL10			
0	0	0	0	24 MHz	5 MHz	0
1	0	0	0	25 MHz	4 MHz	1
0	1	0	0	26 MHz	3 MHz	2
1		0	0	27 MHz	2 MHz	3
0	0	1	0	28 MHz	1 MHz	4
1	0	1	0	29 MHz	DC	5
0	1	1	0	30 MHz	1 MHz	6
1	1	1	0	31 MHz	2 MHz	7
0	0	0	1	32 MHz	3 MHz	8
1	0	0	1	33 MHz	4 MHz	9

Figure 6-7. Frequency Extender, Troubleshooting Chart

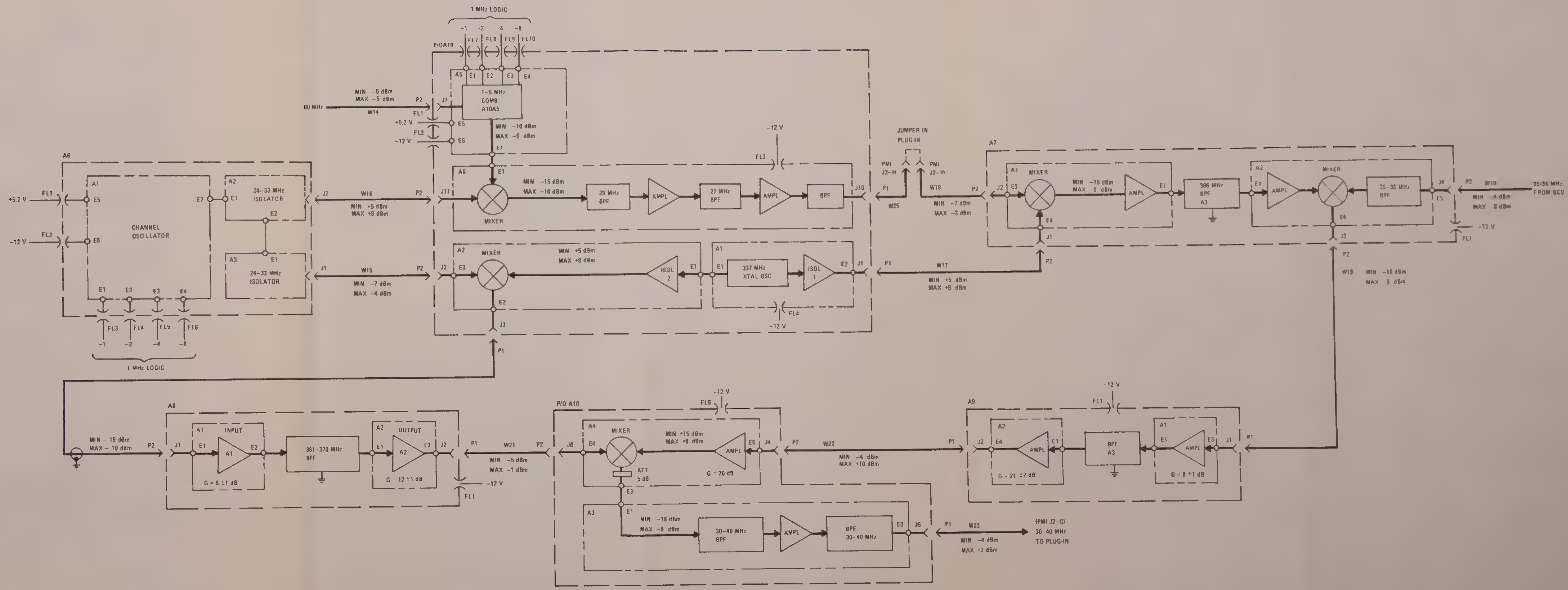


Figure 6-8. Frequency Extender, Servicing Block Diagram

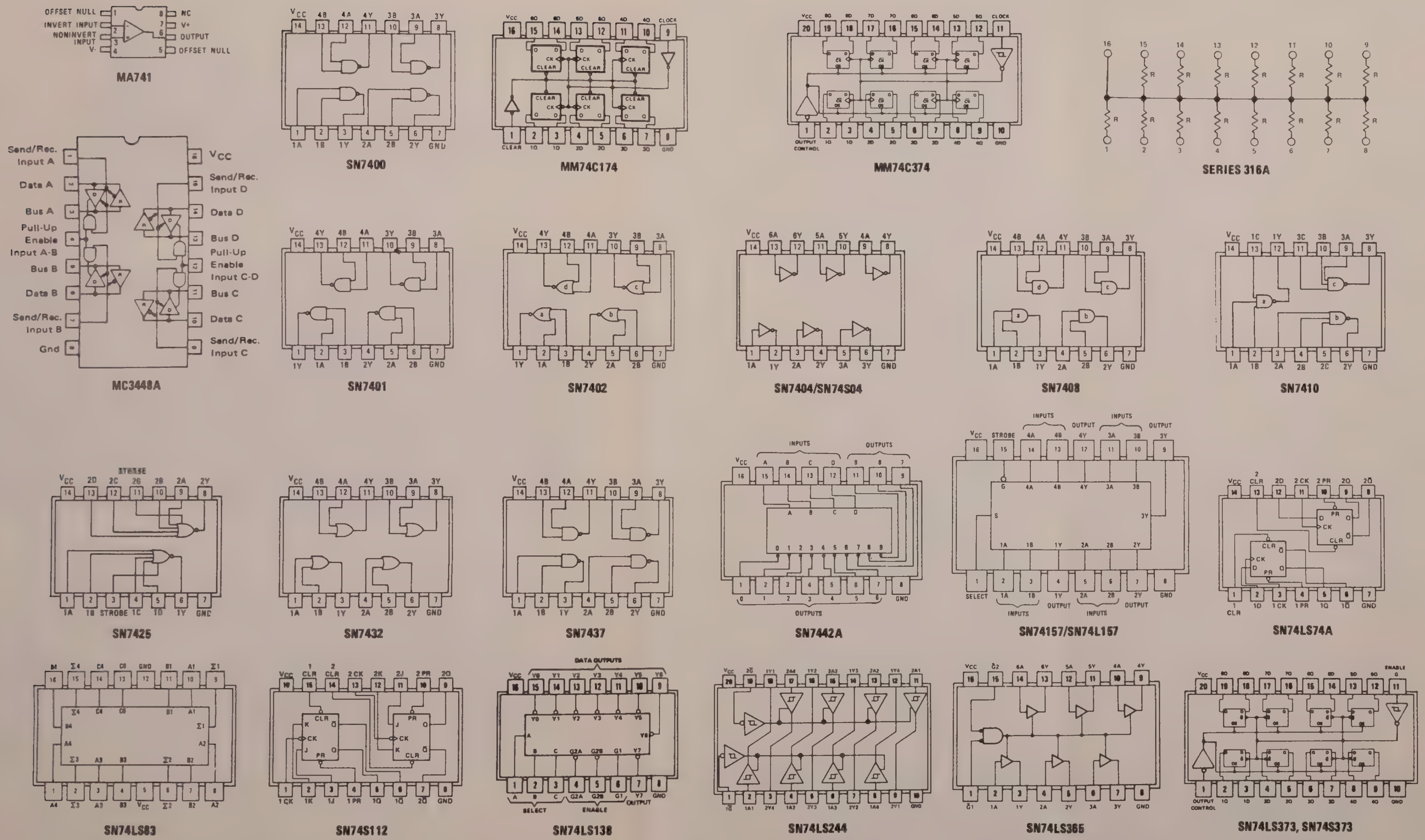


Figure 6-10. Integrated Circuits

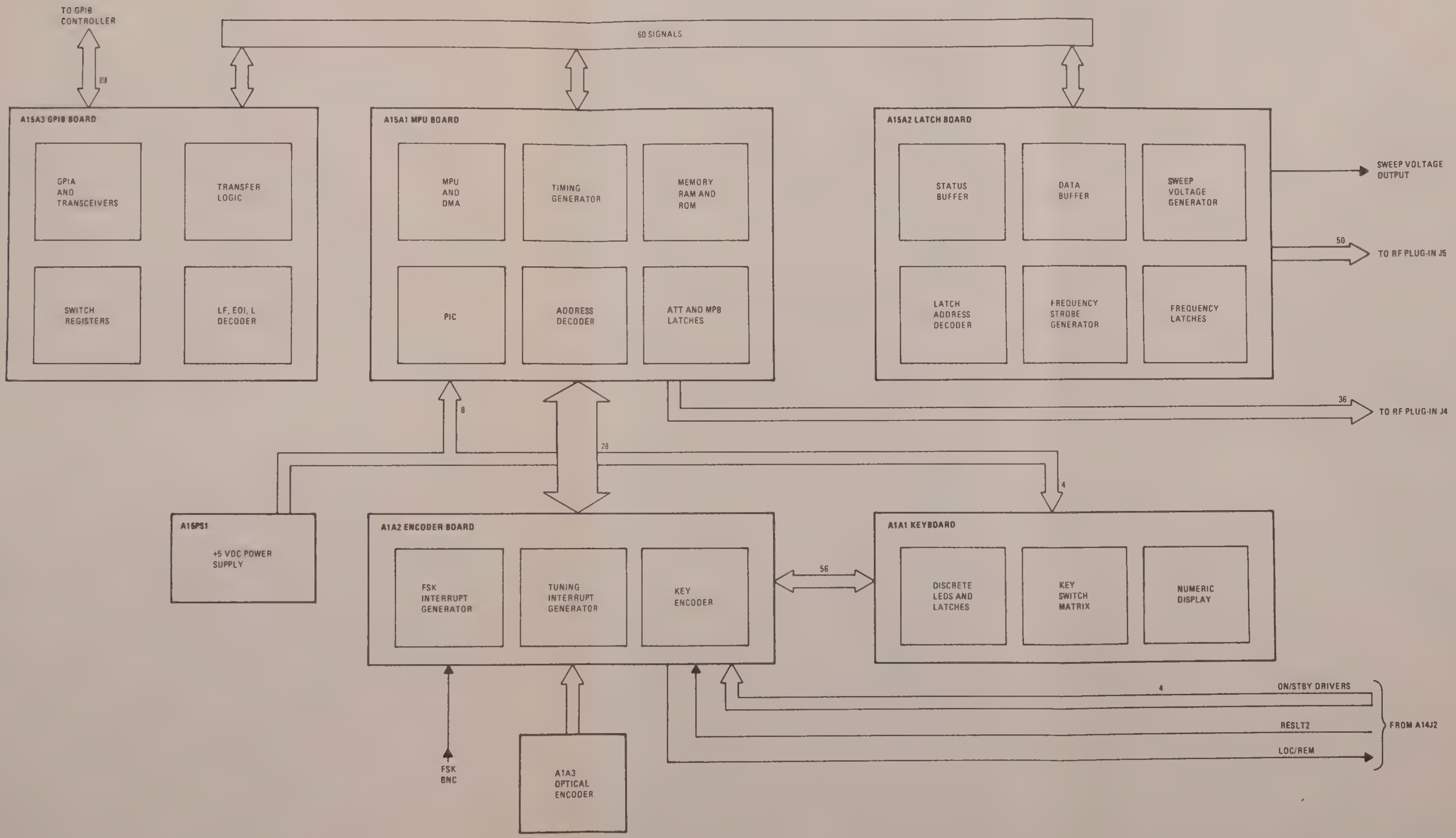


Figure 6-12. Keyboard Controller Subsystem, Block Diagram

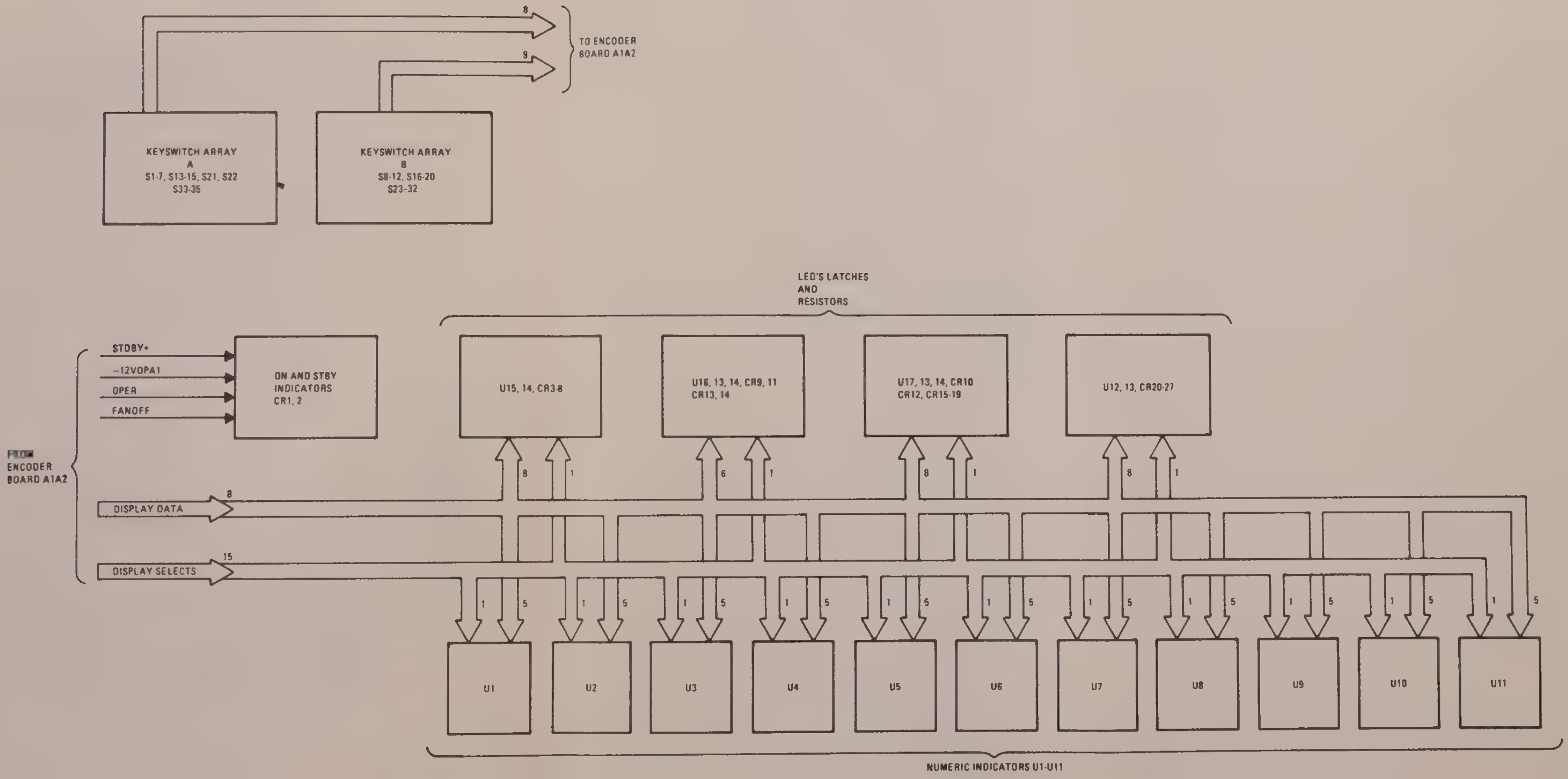


Figure 6-13. Keyboard A1A1, Block Diagram

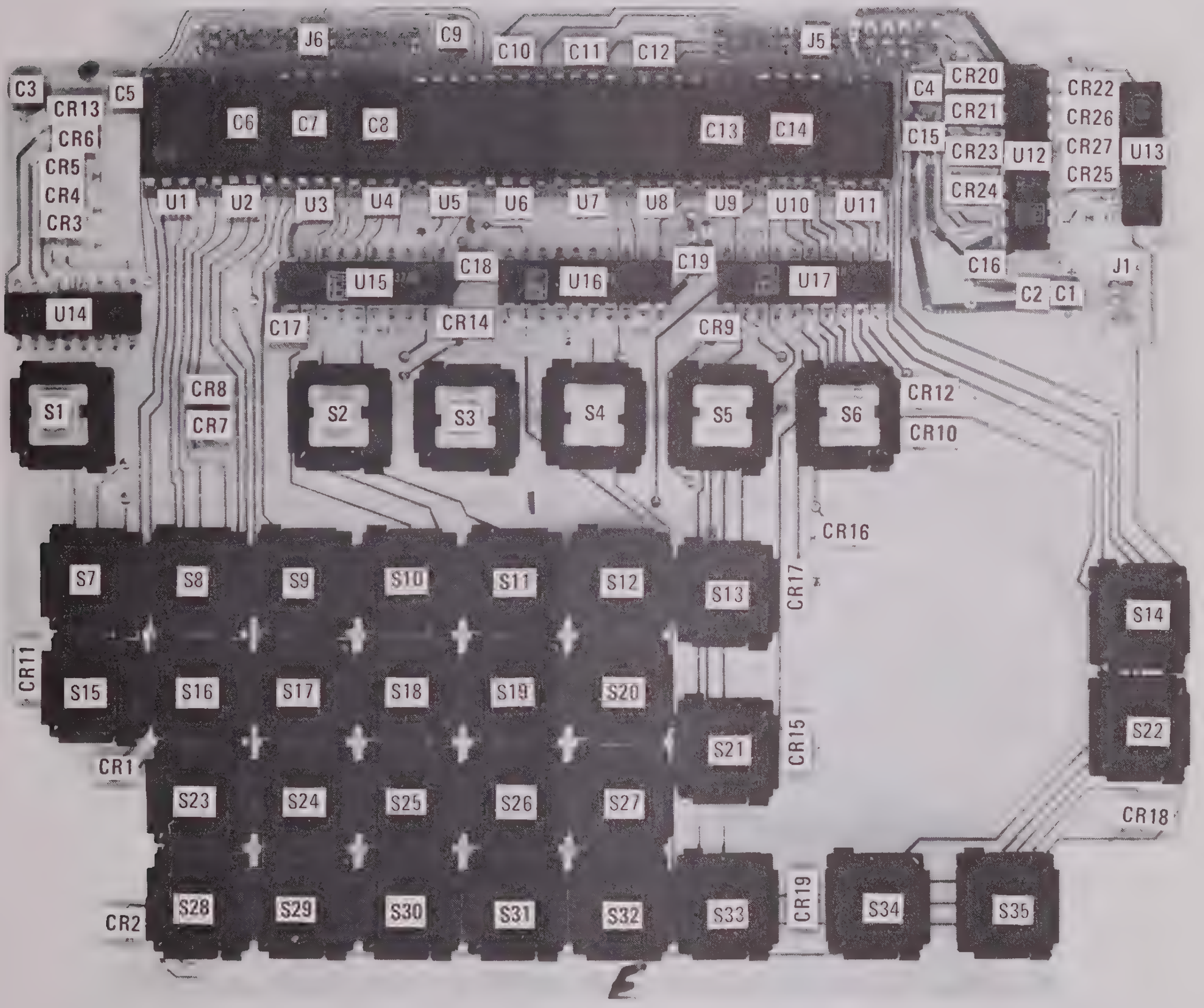
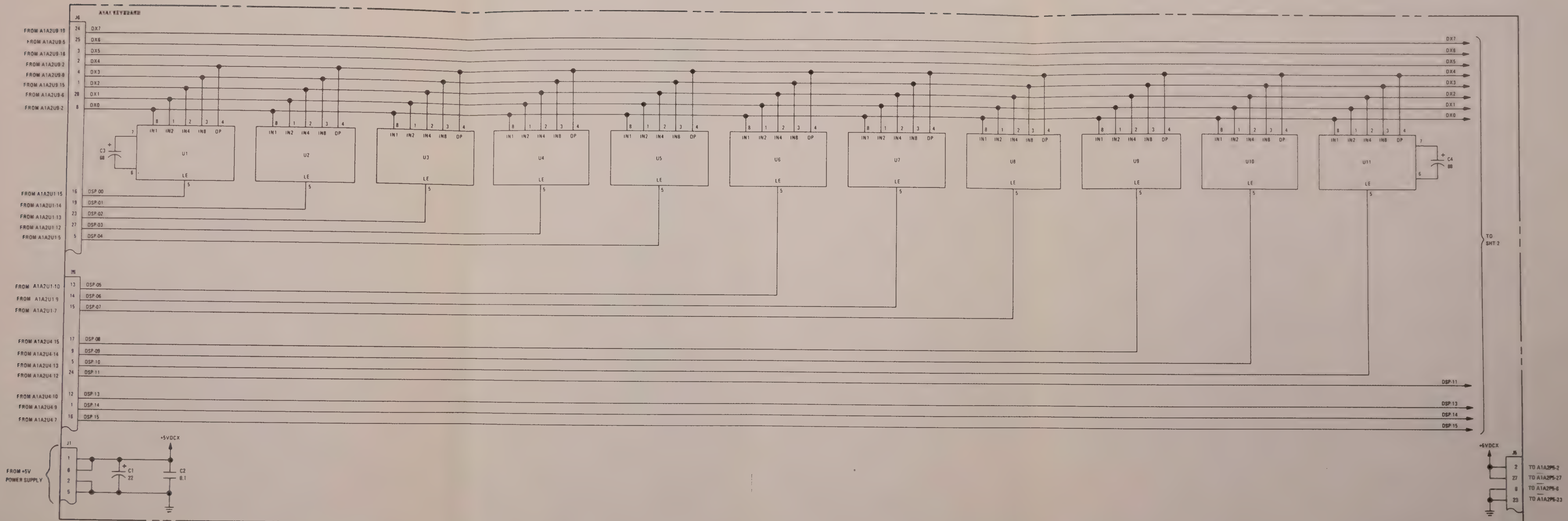


Figure 6-14. Keyboard A1A1, Component Locations



NOTES

1. UNLESS OTHERWISE SPECIFIED
   CAPACITOR VALUES ARE IN MICROFARADS.

Figure 6-15. Keyboard A1A1, Schematic Diagram (Sheet 1)

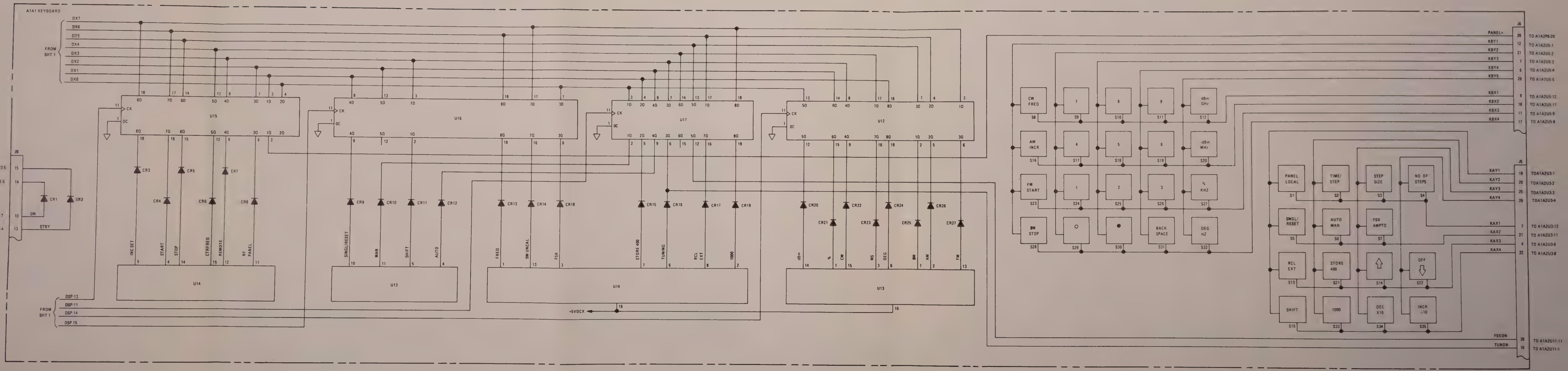


Figure 6-15. Keyboard A1A1, Schematic Diagram (Sheet 2)

6-35. The latch outputs also generate three signals used external to this board. They are the FSKON- TUNON- and PANEL+ signals. The FSKON- and TUNON- signals are used to enable the FSK and TUNE interrupt generators on the encoder board. The PANEL+ signal is used to generate the LOC/REM signal on the encoder board.

6-36. The ON and STBY LEDs are not driven by the latch outputs. These LEDs are driven by external signals. The cathode of the ON LED is driven by the -12VOPA1 signal and its anode is driven by the OPER signal. The cathode of the STBY LED is driven by the FANOFF signal and its anode is driven by STDBY+.

6-37. **ENCODER BOARD ASSEMBLY A1A2.** (Figures 6-16 through 6-18). The Encoder board contains the following major component blocks:

a. Key Encoders
b. Keyboard Interrupt Generator
c. Tuning Interrupt Generator
d. FSK/EXT Interrupt Generator
e. Reset Control
f. Display Address Decoders
g. Display Data Buffer
h. Resolution Control
i. LOC/REM Generator

6-38. **Key Encoders (U3, U5).** These key encoders provide the necessary logic to fully encode the two arrays of SPST switches located on the keyboard. The internal debounce circuit, with the external 1.0μf capacitor allows a switch debounce period of 10 ms. The scan rate of approximately 60 Hz is accomplished with an external 1.0μf capacitor.

6-39. The data available output (DAV) goes to a high level when a valid keyboard entry has been made. The DAV output returns to a low level when the entered key is released, even if another key is depressed. The DAV will return high to indicate acceptance of the new key after the debounce period. This two key roll-over is provided between any two switches.

6-40. An internal register remembers the last key pressed, even after the key is released. The tri-state data outputs allow for the outputs of the two encoders to be OR- tied together. These outputs are enabled by driving the OE (output enable) low.

6-41. **Keyboard Interrupt Generator (U2, U7).** The function of the keyboard interrupt generator is to generate the KBDIRQ signal whenever a key is pressed. This circuit maintains the two key roll-over effect between the two encoders. This circuit also generates a data bit to indicate which encoder is sending data. The circuit functions as follows:

6-42. When a key is pressed in array A, the DAV signal (U3-13) goes high after the debounce period plus the scan time (30 ms maximum). Since U7-8 is high at this time, U7-6 goes low. This does two things. First it forces U7-11 to go high and U7-3 to go low. The output enable of U3-14 is activated which enables the data outputs of U3 with the 5 bit code of the key pressed. The sixth bit of the key-code is generated by by U7-11 and is used to identify which encoder is active. It will be high when encoder A is enabled and low for encoder B.

6-43. The second result of U7-6 going low, is to cause U2-9 Q to go low. This causes the KBDIRQ signal U6-10 to go active low. The MPU will respond to the KBDIRQ by setting the RDKBD- (read keyboard) signal U10-1 low. This will enable the keyboard data buffer U10. The MPU will then read the six bit key-code generated. After the code is read, the KBDIRQ will be reset by the MPU. This is done by activating the RSKBD- (reset keyboard interrupt) signal. When RSKBD- goes low, both sections of the U2 flip-flop are preset, causing KBDIRQ to go high.

6-44. If a key was pressed in array B while the key in array A is still held down, a lockout effect takes place which prevents U7-8 from going low and causing an interrupt. When U3-13 goes low as a result of releasing the first key, lockout is removed from encoder B, allowing U7-8 to go low, and thereby enabling the U5 outputs, setting the identifier bit U7-11 low, and activating the KBDIRQ.

6-45. **Tuning Interrupt Generator.** The function of the tuning interrupt generator is to generate the two directional interrupts CWXIRQ and CCWIRQ. CWXIRQ is generated for clockwise rotation and CCWIRQ is generated for counterclockwise rotation of the tuning control. When the tuning control is rotated, the optical encoder will generate the two outputs, OPAOUT and OPBOUT. These signals are referred to as quasisquare waves and have the phase relation shown in Figure 6-18.

6-46. The Q1 and Q2 transistors and the resistors R5 through R10 are used to increase the current drive of the encoder signals. The R5, R6 and R10, R9 resistor combinations are used to bias the base of Q1 and Q2. The transistors will switch when the inputs (OPAOUT and OPBOUT) cross at about 2.2 volts. The result is a square wave being generated at the collector of each transistor, with the same phase relation as the original signals.

6-47. During clockwise rotation, the rising edge of the A signal clocks a low to the CWXIRQ U13-5 output, and the rising edge of the B signal clocks a high to the CCWIRQ U13-9 output. This generates the clockwise interrupt signal. The MPU will process this interrupt and then activate the RSTUN- (reset tune) signal to reset the interrupt.

6-48. The counterclockwise interrupt is generated in a similar manner. The rising edge of the A signal would clock a high to CWXIRQ and the rising edge of B would clock a low to CCWIRQ, thereby generating the counterclockwise interrupt.

6-49. **FSK/EXT Interrupt Generator.** The function of this circuit is to generate two interrupts, FSLIRQ and FSHIRQ. The FSLIRQ will be generated on the falling edge of the FSK-IN signal and the

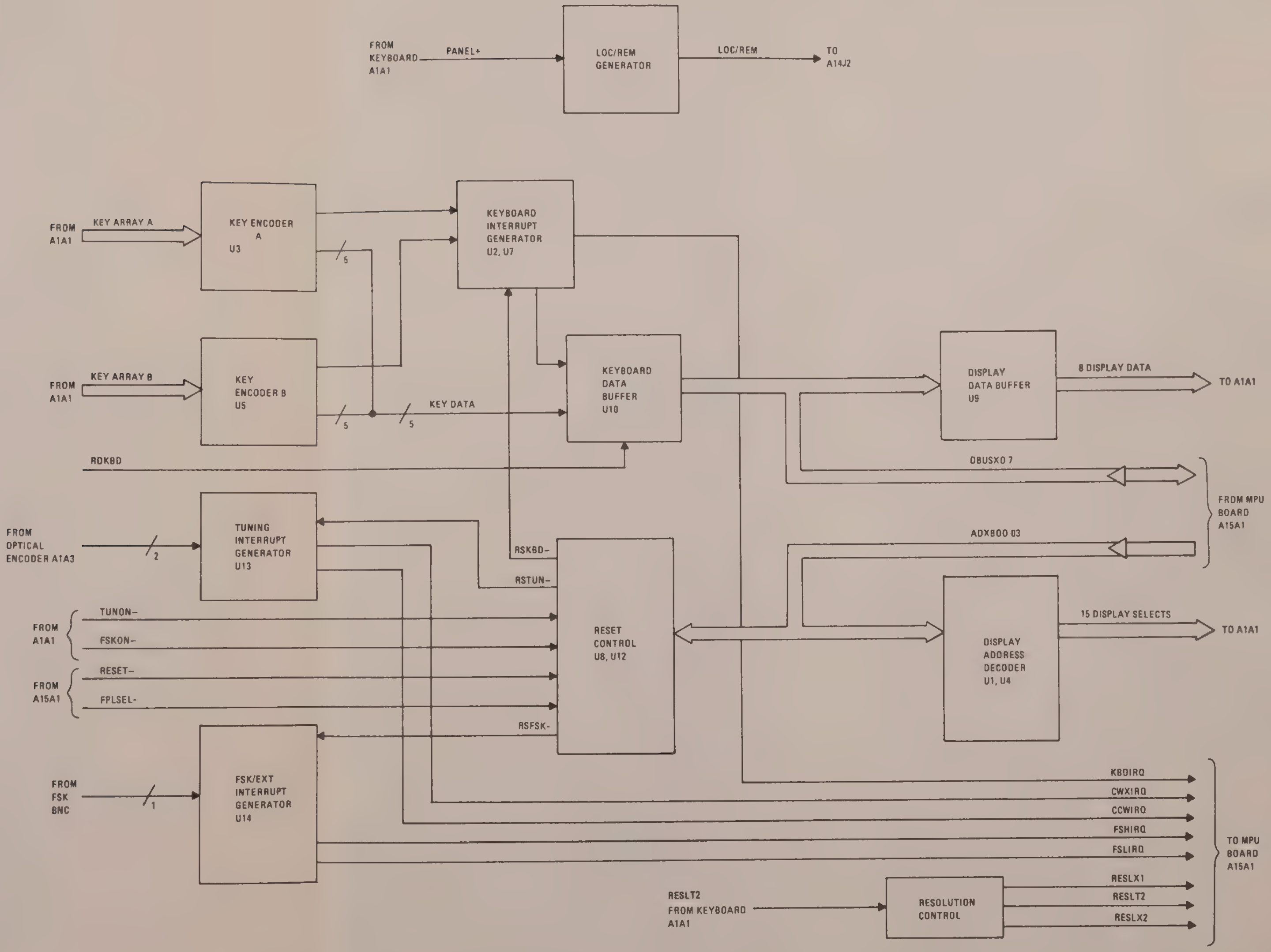


Figure 6-16. Encoder A1A2, Block Diagram

FSHIRQ will be generated on the rising edge of the FSK-IN signal. The R4, 10k resistor is used to pull-up the input when either no generator is connected or when an open collector type of driver is employed to generate the FSK-IN signal. This input is accessed at the front-panel BNC connector marked FSK. Diode CR1 will protect the input U11-9 from overshoots above 5.7 volts. The CR2 diode will protect this input from undershoots below 0.7 volts. Inverter U11 provides 0.4 volts of hysterisis to provide greater noise immunity to the FSK-IN signal.

6-50. When FSK-IN goes from high to low, U11-8 goes low to high. This will clock a low to FSLIRQ (U14-5). This is the low FSK transition interrupt to the MPU. The MPU will process this interrupt and then activate the RSFSK- (reset FSK). This will reset the interrupt.

6-51. When FSK-IN returns to the high state, the FSHIRQ signal U14-9 will go low. This is the high FSK transition interrupt and will be processed and reset similarly to FSLIRQ.

6-52. Reset Control. The function of the reset control circuit is to create the three interrupt reset signals RSKBD-, RSTUN-, and RSFSK-. When the system is powered-up, the RESET- signal will pulse low and force all three reset signals to go active low thereby resetting all three functions.

6-53. When the tuning control is disabled, the TUNON- signal will be high and RSTUN- U12-6 will be low. This will disable the tuning interrupts. The tuning LED will be out at this time. When the tuning control is enabled, the LED will go on and the TUNON- signal will go low. This will allow RSTUN- to go high because U12-3,4 and 5 are now high. When the MPU receives a tuning interrupt it will reset this interrupt by pulsing FPSEL- (front-panel select) low and ADXB01 high. This will set U8-11 low and U12-6 (RSTUN-) low, thereby resetting the tuning interrupts.

6-54. The FSK reset (RSFSK-) signal is generated in a similar manner. When FSKON- is high, the RSFSK- is forced low disabling the FSK interrupts. When FSKON- is low, the RSFSK is high because U12-9, 10 and 11 are all high. When the MPU desires to reset the FSK interrupts, it will activate FPSEL- low and ADXB02 high, causing U8-6 to go low and U12-8 (RSFSK-) to go low, resetting the FSK interrupt. The keyboard interrupt reset (RSKBD-) has no disabling signal as the other two have. It is, however activated in the same manner as the other two are, when ADXB00 goes high and FPSEL- goes low.

6-55. Display Address Decoders. The display address decoders U1 and U4 are the 3 to 8 decoders. They are used to generate the 15 enable strobes for the numeric indicators and the LED latches.

6-56. The AB and C inputs of each decoder is driven by ADXB00, ADXB01 and ADXB02 address lines respectively. ADXB03 drives the active low enable (G2A) of U1 and the active high enable (G1) of U4. Using this arrangement, each hexidecimal code on the four address lines will activate a unique Y output (DSP-00 through DSP-15). These outputs are the enable strobes.

6-57. The selected output will not activate however until the WRTDSP (write display) signal goes low. This signal drives the active low enable (G2B) of each decoder. The selected Y output will remain low until the WRTDSP returns high.

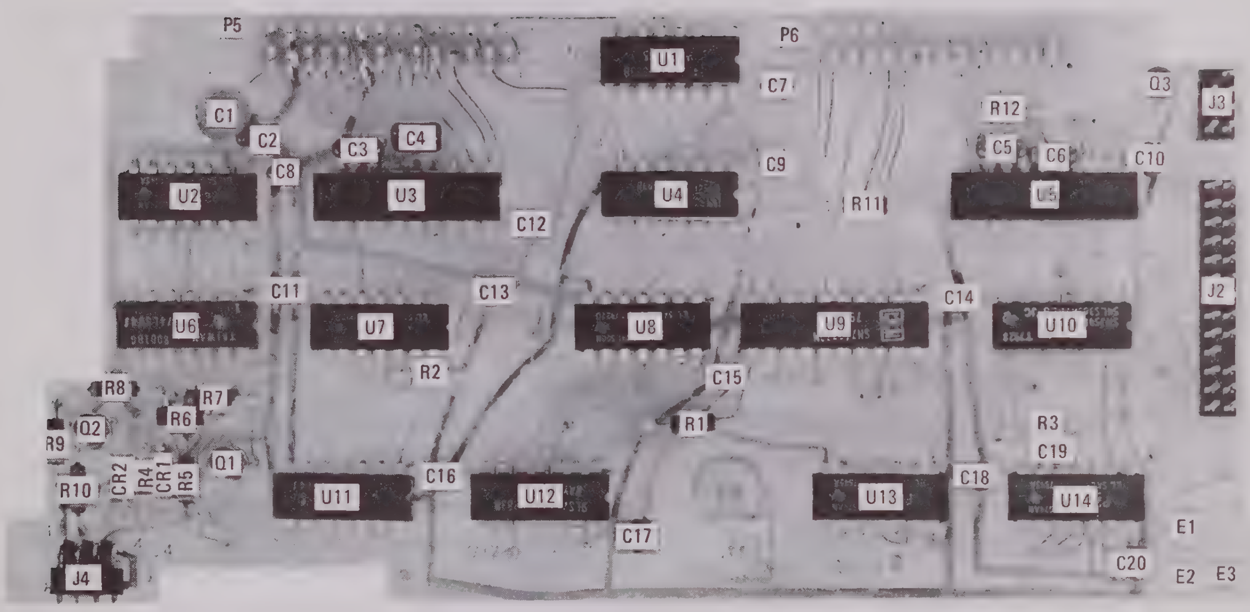
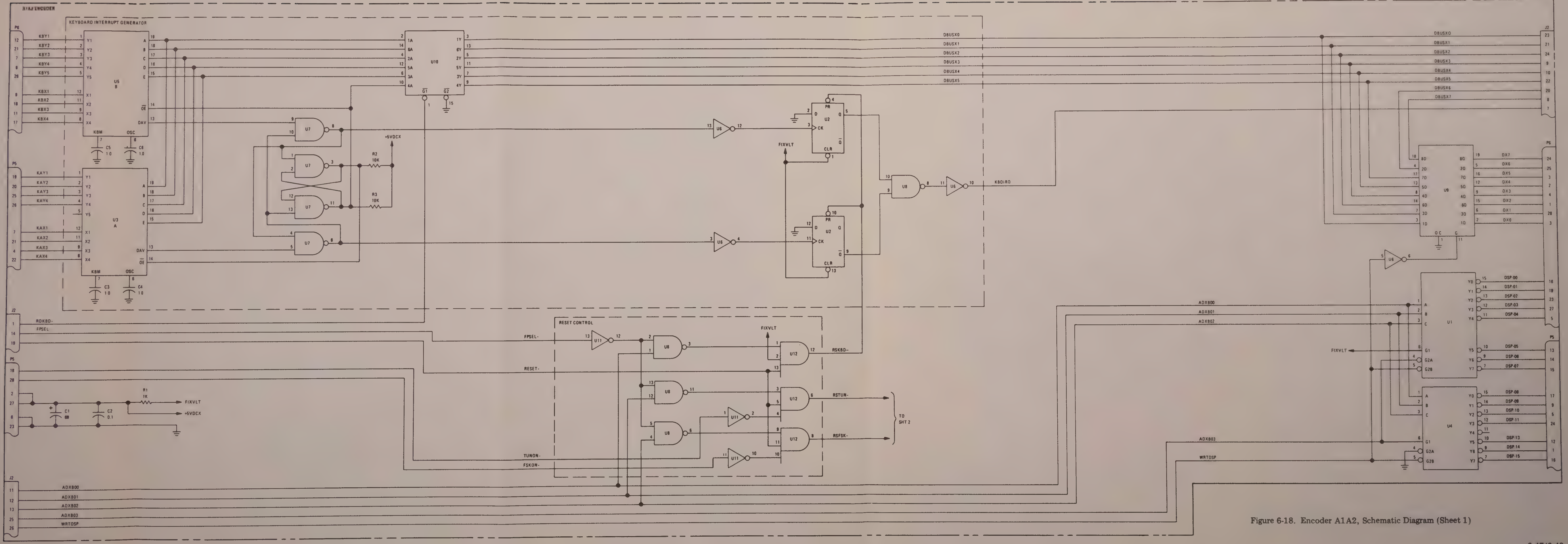


Figure 6-17. Encoder A1A2, Component Locations



NOTES
1. UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS, ±5% TOLERANCE
CAPACITOR VALUES IN MICROFARADS.

Figure 6-18. Encoder A1A2, Schematic Diagram (Sheet 1)

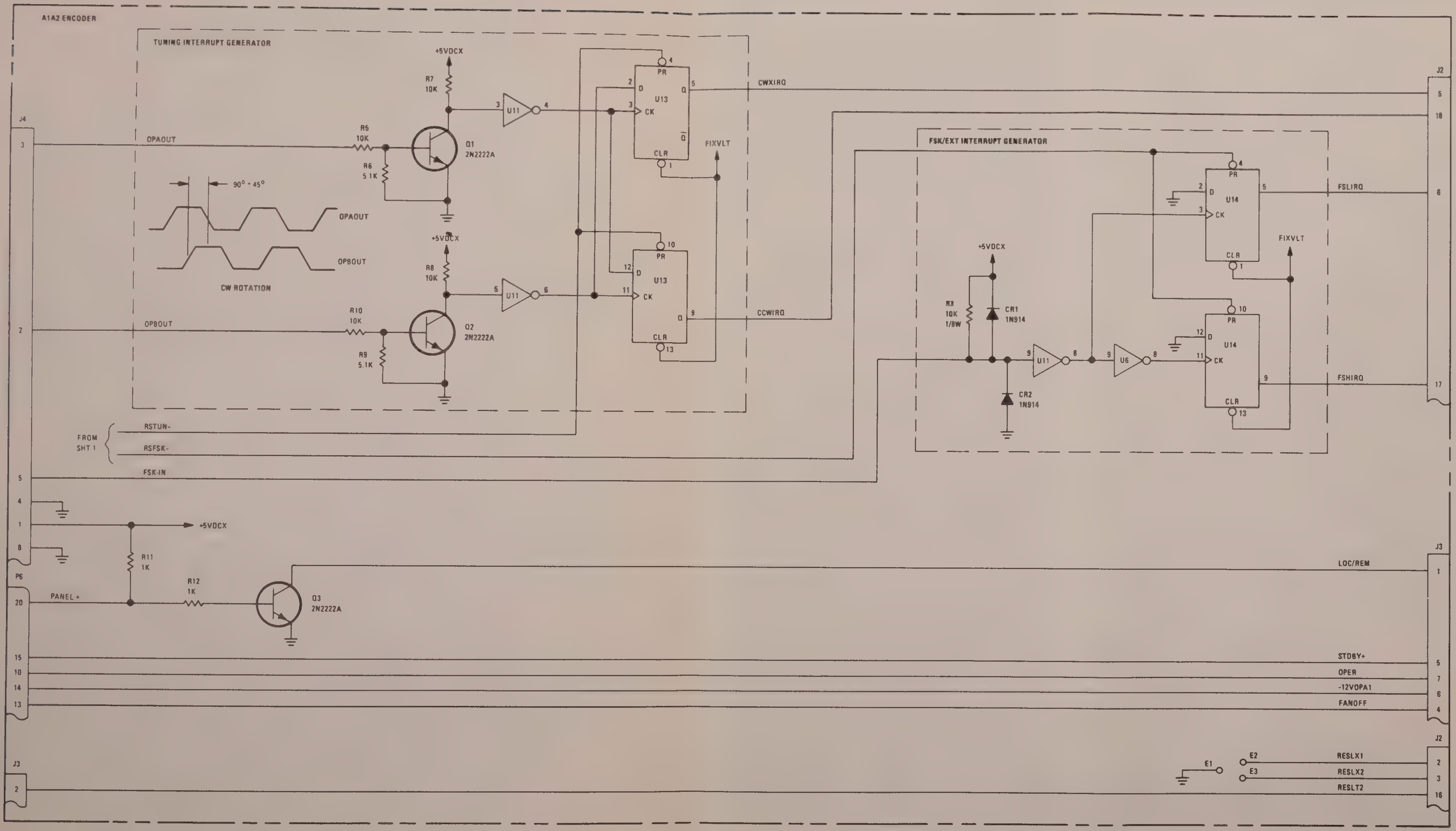


Figure 6-18. Encoder A1A2, Schematic Diagram (Sheet 2)

6-58. **Display Data Buffer.** The display data buffer U9 is used to provide the high drive current needed on the display data bus (DX0-DX7). It is also used to latch the display data, thus providing the long data hold time (50 nanoseconds minimum) required by the numeric indicators.

6-59. The output control (OC) input of U9 is wired to ground for continuous operation since there are no other driving elements on the display data bus.

6-60. The 1D through 8D inputs of the display data buffer are the DBUSX0 through DBUSX7 signals which are received from the MPU PC board A15A1.

6-61. The G (enable) input of U9 goes active high when WRTDSP goes active low. The eight latches in U9 are transparent D type latches meaning that while the enable (G) is high, the Q outputs will follow the data (D) inputs. When the enable is taken low by WRTDSP going high, the output will be latched at the level of the data that was setup.

6-62. **Resolution Control.** This circuit has three output signals which are used by the MPU to adjust the frequency display to the proper resolution. The RESLX1 and RESLX2 signals are permanently conditioned to a logic 1 or 0. A jumper to ground (E1) will condition a low. No jumper will condition a high because of the pull-up resistor located on the latch board. The jumper code can be determined from the following list.

Resolution	Jumpers
0.1 Hz	None
1.0 Hz	E1 to E2
10.0 Hz	E1 to E3
100.0 Hz	E1 to E2, E1 to E3

6-63. When the 380 is programmed to a frequency in the highband ($\geq$ 60 MHz), the resolution drops by one decade. The RESLT2 signal, which is generated in the plug-in, will go high when a highband frequency is programmed. The MPU uses this information to adjust the displayed resolution accordingly. For example, if no jumpers are installed, the displayed frequency resolution is 0.1 Hz for lowband (RESLT2 low) and 1.0 Hz for highband (RESLT2 high).

6-64. **LOC/REM Generator.** This circuit generates the LOC/REM signal which is used by the plug-in to select between keyboard or RF panel control of the amplitude and modulation functions.

6-65. The input to this circuit is the PANEL+ signal generated on the keyboard. When high, the PANEL+ signal turns the Q3 transistor on, which pulls LOC/REM low (local) and enables the RF panel amplitude and modulation controls. When the PANEL+ signal is low, the transistor is turned off and LOC/REM is pulled high by a resistor located in the plug-in. This will enable the remote inputs for modulation and amplitude, which in this case comes from the MPU board.

6-66. LOWER AND HIGH ORDER BCD SECTION. The BCD section consisting of modules A2 and A4 form the heart of the frequency synthesizer mainframe. The standard unit has 6 BCD decades generating 10^6 frequency steps with a 1.0-Hz resolution. Option -001 provides 7 decades with 10^7 steps and 0.1-Hz resolution. The four lower order decades, or five decades in the 001 option, are housed in lower order BCD A2. The function of each decade is essentially similar, therefore, the following paragraphs describe the basic theory of a BCD decade. The details of how each module differs will be discussed in later paragraphs under the separate modules.

6-67. Figure 6-19 shows the basic block diagram of all BCD decades. The function of the decade is to provide 10 discrete frequency outputs controlled by a BCD logic code. Given an input frequency of 35.0 MHz and the two comb line frequencies of 64 MHz and 65 MHz, the output frequency will be between 35.0 and 35.9 MHz, depending on the BCD code. If the BCD code is a 3, the output will be 35.3 MHz.

6-68. To understand the operation of the decade, trace a signal through the block diagram of any BCD decade. A starting frequency is chosen at 35 MHz and all RF switches are shown in their 0 position; in other words, a BCD 0 is programmed. In the BCD-1 mixer, a 35-MHz input signal mixes with the 65-MHz LO signal to form a 30-MHz product. This 30-MHz product passes through a 28-30 MHz bandpass filter and is applied to a flip-flop operating in a divide-by-two mode. The output of the flip-flop is a 15-MHz signal which is passed through a 14-15 MHz bandpass filter. This 15-MHz signal is applied to the second mixer where it mixes with 64 MHz generating a 49-MHz signal at the IF port. The 49-MHz signal passes through a 49-50 MHz bandpass filter and again into a flip-flop acting as a divide-by-two circuit. The output of this second divider is a signal of 24.5 MHz. This signal passes through a 24.5 to 25.5 MHz band-pass filter and is applied to the third mixer. The 24.5-MHz signal mixes with 64 MHz generating a signal at 40.5 MHz. This in turn passes through a 38.5 to 40.5 MHz band-pass filter and again a divide-by-two flip-flop generating a signal of 20.25 MHz. This signal passes through a 19.25 to 20.25 MHz band-pass filter and becomes the RF signal for a fourth mixer. The 20.25-MHz signal mixes with 64 MHz producing a mixed product at 43.75 MHz. This frequency is divided by 5 and then multiplied by 4 producing a 35-MHz output. Therefore, for a 35-MHz input with all switches in the zero position, a 35-MHz output results. Now, leave the BCD code in the zero position and apply a 36-MHz signal to the input, which is a 1-MHz change on the input frequency. When tracing this signal through, it is found that out of the first mixer 29 MHz appears, and after the frequency divider the signal is 14.5 MHz. Mixing this again with 64 MHz results in a 49.5-MHz signal and after the frequency divider, 24.75 MHz. After the third mixer the signal is 40.25 MHz and after the fourth mixer the signal is 43.825 MHz resulting in 35.1 MHz at the output. From this example, it is seen that 1 MHz change on the input produces 0.1 MHz on the output or an effective division ratio of 10 going through any BCD decade. This is an important fact because the divide by 10 provided 20 dB of improvement in spurs and noise through each decade.

6-69. To further understand the operation, trace through what happens as the BCD-8 switch is set to logic 1. If the BCD-8 switch is thrown to the 1 position, the input of the mixer increases by 1 MHz. The mixer is followed by a multiplication of 0.8 so that the output signal increases in frequency by 0.8 MHz. Thus,

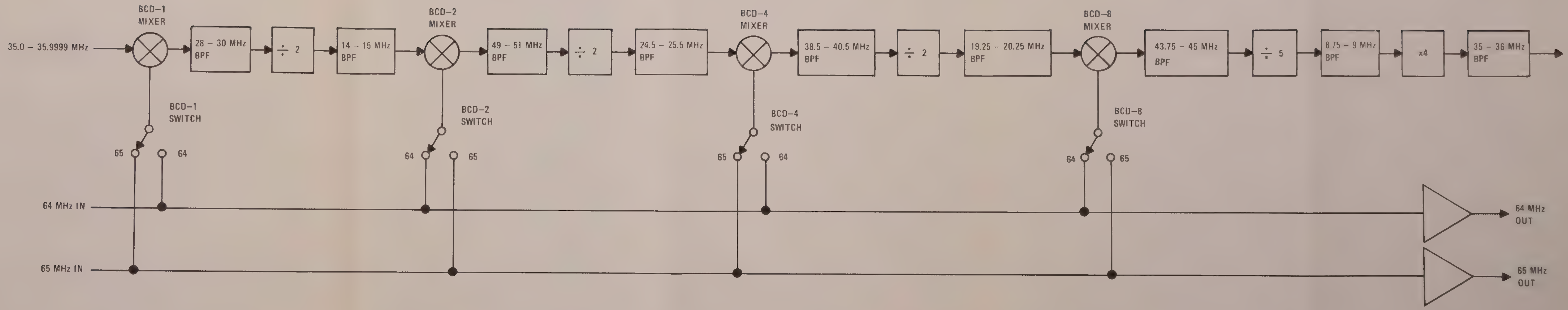


Figure 6-19. BCD Decades, Block Diagram

this switch has the relative weight of 8. A binary divider separates the BCD-4 mixer from the BCD-8 mixer; in effect a 1-MHz change from the BCD-4 switch is half of the BCD-8 so this switch has a relative weight of 4. In a similar manner, the BCD-2 switch has a relative weight of 2 and the BCD-1 switch has a relative weight of 1. Therefore, each decade, for a 35.0 MHz input, can generate an output of 35.0, 35.1 all the way up to 35.9 directly from a BCD code. In addition, if the BCD code were a 1 for 35.0 MHz input, then the output frequency would be 35.1 MHz. However, if the input frequency was 35.5, then the output would be 35.15. In other words, for a frequency input of 35.X and a BCD code into the decade of N, the output frequency is 35.NX. Therefore, by cascading 6 of these decades it is seen that the output frequency is anywhere from 35 to 35.999999 MHz in 1 Hz steps. Table 6-2 shows the output frequency and output of the four 64/65 MHz switches for each BCD code on the input to the decade. The output frequency assumes a 35.000000 MHz input.

6-70. LOWER ORDER BCD A2. (Figure 6-20).

6-71. Lower order BCD module A2 (Figure 6-21) in the mainframe consists of 1-kHz BCD decade board A2A1 and three, 0.1-100 Hz BCD decade boards, A2A2, A2A3, and A2A4. A fifth position, A2A5, contains a jumper board. This jumper is removed, and another BCD board is inserted when the -001 option is included to provide another decade of resolution.

6-72. 1-kHz DECADE BOARD A2A1. (Figure 6-22). The 1-kHz, decade board (Figure 6-23) controls the 1-kHz digit in the frequency synthesizer output. The A2A1 output is 35 to 35.999995 MHz depending on the input frequency and BCD code from the 1-kHz logic as previously described. The output level should be greater than -8 dBm. This board contains 64-MHz and 65-MHz buffer amplifiers Q33 and Q34, respectively, which drive the 64 and 65 MHz inputs of A2A2 through A2A5. The level of these signals should be greater than 0 dBm. The remainder of this discussion assumes an input of 35.0000000 MHz.

TABLE 6-2. BCD SWITCH CODING

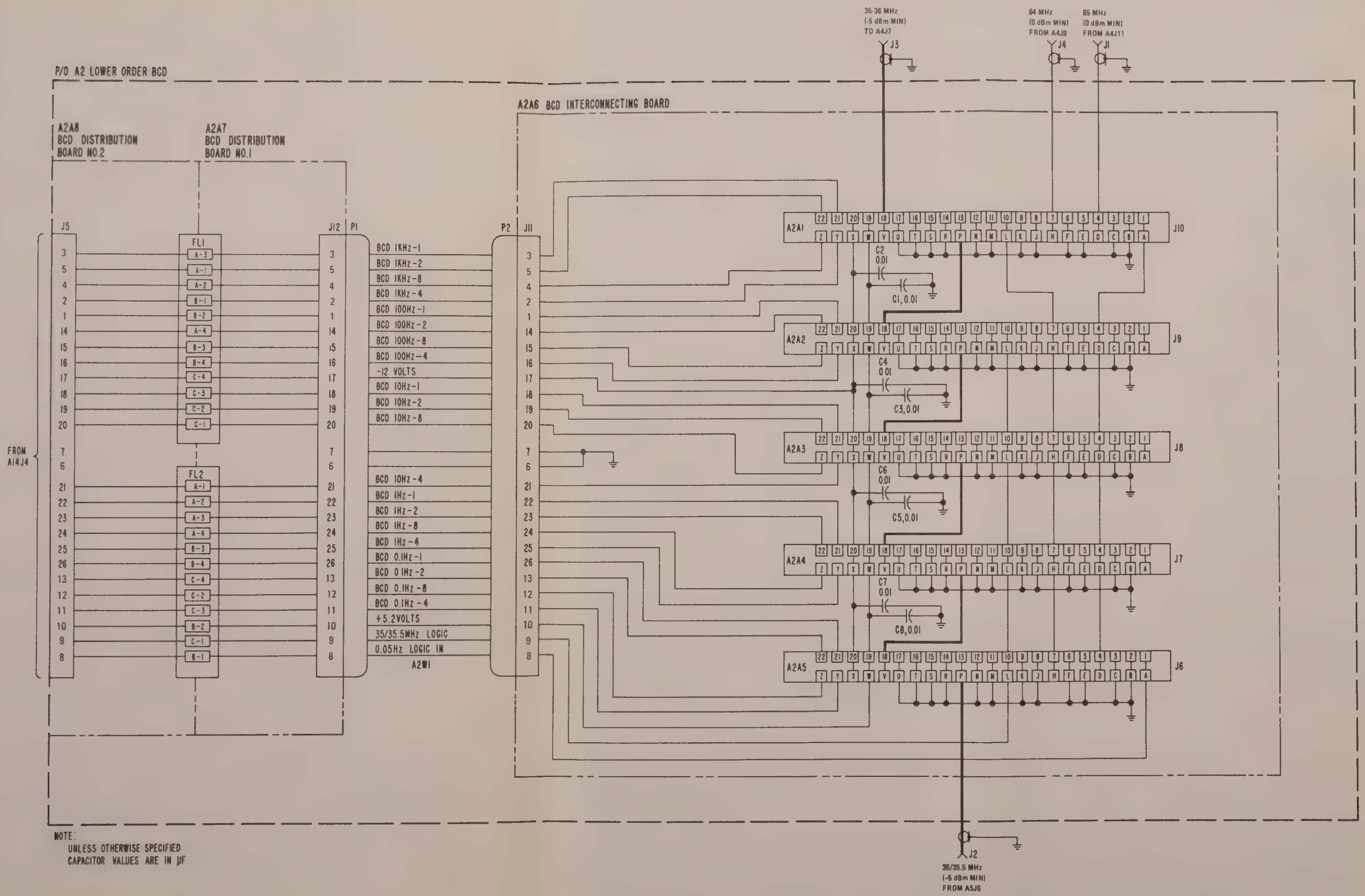
Output Frequency	BCD Code				BCD-1 Switch	BCD-2 Switch	BCD-4 Switch	BCD-8 Switch
	–1	–2	–4	–8				
35.00	0	0	0	0	65	64	65	64
35.10	1	0	0	0	64	64	65	64
35.20	0	1	0	0	65	65	65	64
35.30	1	1	0	0	64	65	65	64
35.40	0	0	1	0	65	64	64	64
35.50	1	0	1	0	64	64	64	64
35.60	0	1	1	0	65	65	64	64
35.70	1	1	1	0	64	65	64	64
35.80	0	0	0	1	65	64	65	65
35.90	1	0	0	1	64	64	65	65

6-73. The 35-MHz input signal to A2A1 is ac coupled through capacitor C1 to BCD-1 mixer integrated circuit U1-pin 11. The signal at this point is 35 MHz, 0.3V peak-to-peak centered around -7 Vdc. This signal is mixed with 65 MHz from the BCD-1 switch, Q1 through Q7. The 65 MHz enters the U1 mixer at pin 5 at a level of 0.7V peak-to-peak centered around -9.4 Vdc. The 65-MHz and 35-MHz signals are mixed in U1 and the composite signal appears at pin 3 at a level of 0.6V peak-to-peak centered around 2 Vdc. The lower sideband of the 30-MHz composite signal, is selected by 28-30 MHz bandpass filter comprising L1, L2, C9, C10, and C11. The 30 MHz is amplified by driver Q8 to a level of 2 volts peak-to-peak to drive divide-by-two circuit U2. The output of U2 is a 15-MHz square wave at about 2.5V peak-to-peak. This 15.0-MHz square wave is filtered by the 14-15 MHz bandpass filter formed by L4, L5, C13, C14, and C79, and is applied to pin 11 of U3 at a level of 1V peak-to-peak centered around 7.5 Vdc.

6-74. Integrated circuit U3 functions as a BCD-2 mixer. The 64-MHz output of BCD-2 switch Q9 through Q15 is applied to U3 pin 5 at a level of 0.7V peak-to-peak centered on -9.4 Vdc. The 64 MHz mixes with 15 MHz and the composite signal appears at pin 3 at a level of 0.5V peak-to-peak centered around 3.0 Vdc. The lower sideband of this composite signal, 49 MHz, is filtered by 49-51 MHz bandpass filter comprising L6, L7, C22, C23, and C24 and amplified by driver Q16. This signal is applied to a flip-flop which acts as a frequency divider producing 24.5 MHz. The input to U4 pin 13 is a 49-MHz sine wave centered at 1 Vdc and approximately 1.5V peak-to-peak. The output of U4 at 24.5 MHz is passed through a 24.5-25.5 MHz band-pass filter formed by L9, L10, C27, C28, and C29.

6-75. The output of the 24.5-25.5 MHz band-pass filter connects to the BCD-4 mixer, U5 pin 11. The signal is 24.5 MHz at a level of 0.6V peak-to-peak centered at -2.4 Vdc. This signal is mixed in U5 with the output of the BCD-4 switch, a 65-MHz signal of 0.7V peak-to-peak centered around -9.4 Vdc. The BCD-4 switch is made up of transistors Q17 through Q23. The output of the U5 mixer appears at pin 3 at a level of 0.7V peak-to-peak centered around -2.3 Vdc. The lower sideband at this composite signal, 40.5 MHz, is selected by a 38.5-40.5 MHz bandpass filter consisting of L13, L14, C39, C40, and C41, amplified by driver Q24, and applied to U6 at a level of 1.5V peak-to-peak at a dc level of 1.0 volt. Flip-flop U6 functions as a frequency divide-by-two circuit producing a 20.25-MHz output signal. This signal is passed through a 19.25 to 20.25 MHz bandpass filter consisting of L16, L17, L19, C43, C44, C45, C46, and C80.

6-76. The filtered 20.25-MHz signal is the RF input to BCD-8 mixer U7. This input is at pin 11 at a level of 0.8 peak-to-peak centered around -6.6 Vdc. It is mixed with the output of the BCD-8 switch formed by transistors Q25 through Q31. The output of this switch at U7 pin 5 is 64 MHz at 0.7V peak-to-peak centered around -9.4 Vdc. This mixes with the 20.25 MHz producing a composite signal at pin 3 of 1.0V peak-to-peak centered around -1.75 Vdc. The lower sideband of this signal, 43.75 MHz, is selected by the 43.75-45 MHz bandpass filter, consisting of L21-L24 and C54-C59. The signal is amplified by Q35 so that the output of the filter is at a sufficient level for the driver.



NOTE:
UNLESS OTHERWISE SPECIFIED
CAPACITOR VALUES ARE IN µF

Figure 6-20. Lower Order BCD Assembly A2, Interconnecting Diagram

6-77. The filtered signal is amplified by driver Q32 and applied to U8. Integrated circuit U8 is a frequency divider which divides the 43.75 MHz by 5 producing 8.875 MHz rich in harmonics due to fast rise times on the output of U8. The fourth harmonic of the 8.875 MHz signal is selected by the 35-36 MHz bandpass filter consisting of L26, L27, L28, C61, C62, C63, C64, and C65. The input to U8 at pin 6 is 43.75 MHz at 2V peak-to-peak at a level of 1.25 Vdc. The output of the 35-36 MHz filter is 0.4V peak-to-peak or -5 dBm.

6-78. **0.1 to 100 Hz BCD DECADE BOARDS A2A2 THROUGH A2A5.** (Figure 6-24). The 0.1 to 100 Hz BCD decade boards A2A2, A2A3, A2A4, and A2A5 (-001 option) are identical to each other and are similar to A2A1. The only difference between these boards and A2A1, is that these boards do not contain 64 and 65 MHz buffer amplifiers Q33 and Q34. See Figure 6-25 for component locations of board A2A2.

6-79. **HIGHER ORDER BCD A4.**

6-80. Higher order BCD module A4 (Figure 6-26) produces the 100-kHz and 10-kHz decades in the mainframe output. The 10-kHz decade is contained on board A4A11; the 100-kHz decade is contained on boards A4A1 through A4A10.

6-81. **BCD-1 BOARD A4A1.** (Figures 6-27 and 6-28). The input to A4A1 is a 35- to 36-MHz signal at -5 dBm which comes from 10 kHz BCD board A4A11. This signal passes through a lowpass filter (C1, C2, and L1) and a 3-dB pad and is applied to the RF input of mixer M1. The local oscillator for the mixer is 64 or 65 MHz from BCD-1 switch A4A7. The mixed signal is passed through the 28 to 30 MHz bandpass filter consisting of C3 through C6 and L2, L3, and L4 which selects the lower sideband. This signal is amplified in Q1 and applied to U1 which acts as a frequency divide-by-two circuit. The output of U1 is filtered by 14 to 15 MHz bandpass filter C10 through C15 and L7 through L13 which provides a 14-15 MHz signal at E4 at a level of +3 dBm.

6-82. **BCD-2 BOARD A4A2.** (Figures 6-27 and 6-29). The input to BCD-2 board A4A2 is the 14- to 15-MHz output from A4A1. This signal passes through a lowpass filter and attenuator comprising of C1, C2, C3, L1, L2, R1, R2, and R3 and is applied to mixer M1 at a level of -5 dBm. This signal is mixed with 64 or 65 MHz from BCD-2 switch A4A8. The lower order sideband of the mixer is selected by the 49- to 51-MHz bandpass filter consisting of C4 through C7, and L3 through L5. This signal is amplified in Q1 and applied to U1 which acts as a frequency divider-by-two. The output of U1 is filtered by 24.5 to 25.5 MHz bandpass filter C14 through C19 and L8 through L14. The output of this filter appears at E5 at a level of 0 dBm.

6-83. **BCD-4 BOARD A4A3.** (Figures 6-27 and 6-30). The input to BCD-4 board A4A3 is the 24.5- to 25.5-MHz output from A4A2. This signal is passed through a lowpass filter and attenuator comprising of C1, C2, C3, L1, L2, R1, R2, and R3, and applied to mixer M1. This signal is mixed with 64 or 65 MHz from BCD-4 switch A4A9. The lower sideband of this mixer is selected by the 38.5 to 40.5 MHz bandpass filter consisting of C4 through C8 and L3 through L7. This signal is amplified by Q1 and applied to U1 which acts as a frequency divider-by-two circuit. The output of U1 is filtered by 19.25 to 20.25 MHz bandpass filter C16 through C21 and L11 through L17. The output of this filter appears at E3 at a level of +2 dBm.

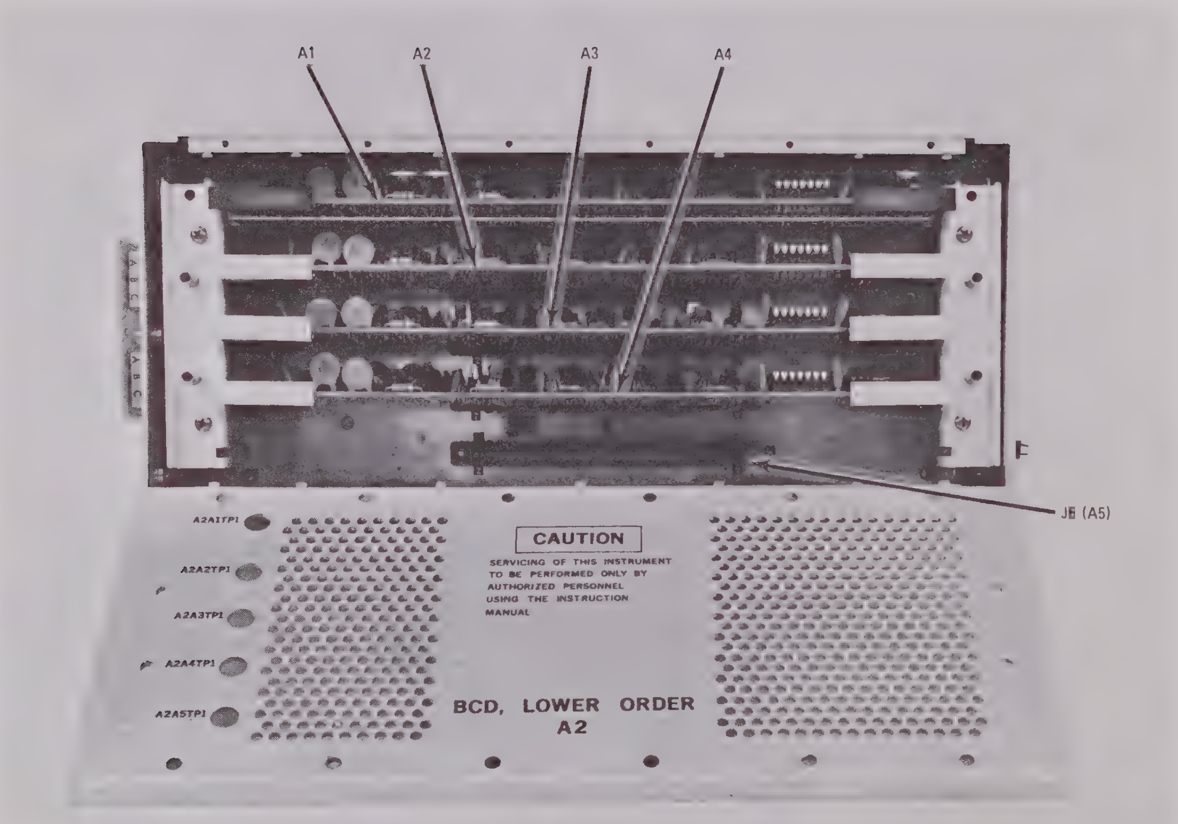
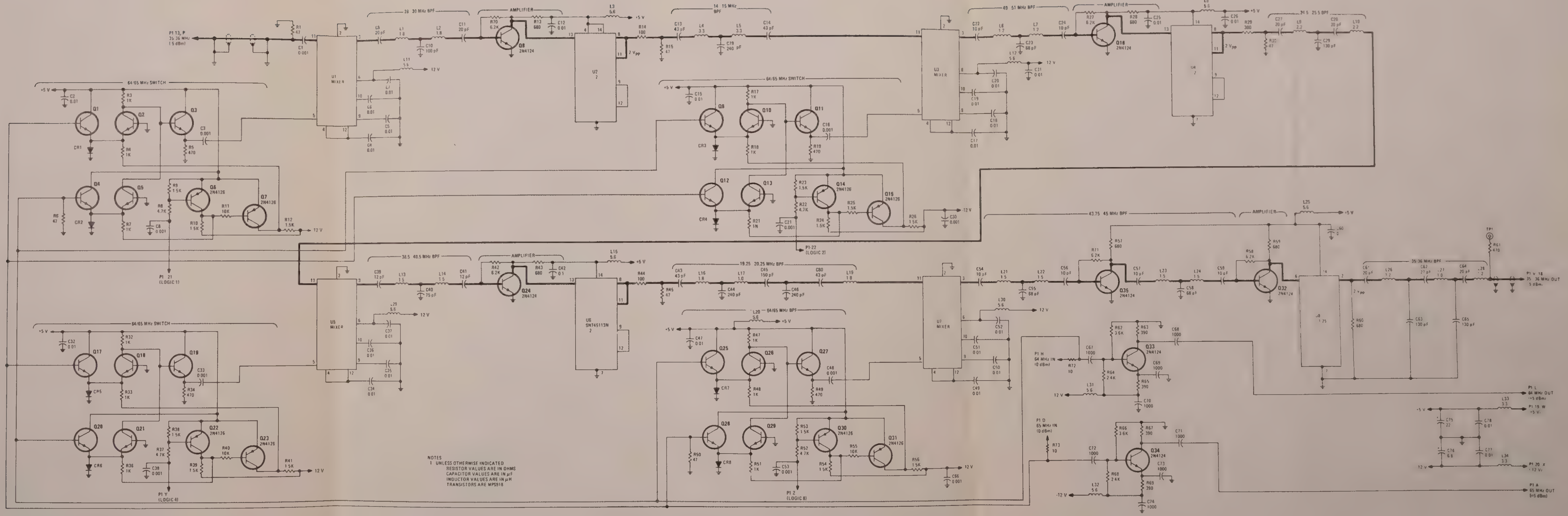

A1
A2
A3
A4
J8 (A5)
A B C
A B C
A2A1TP1
A2A2TP1
A2A3TP1
A2A4TP1
A2A5TP1
CAUTION
SERVICING OF THIS INSTRUMENT TO BE PERFORMED ONLY BY AUTHORIZED PERSONNEL USING THE INSTRUCTION MANUAL
BCD, LOWER ORDER
A2

Figure 6-21. Lower Order BCD Assembly A2



NOTES
1 UNLESS OTHERWISE INDICATED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN µF
INDUCTOR VALUES ARE IN µH
TRANSISTORS ARE MPS918

Figure 6-22. 1-kHz Decade Board A2A1, Schematic Diagram

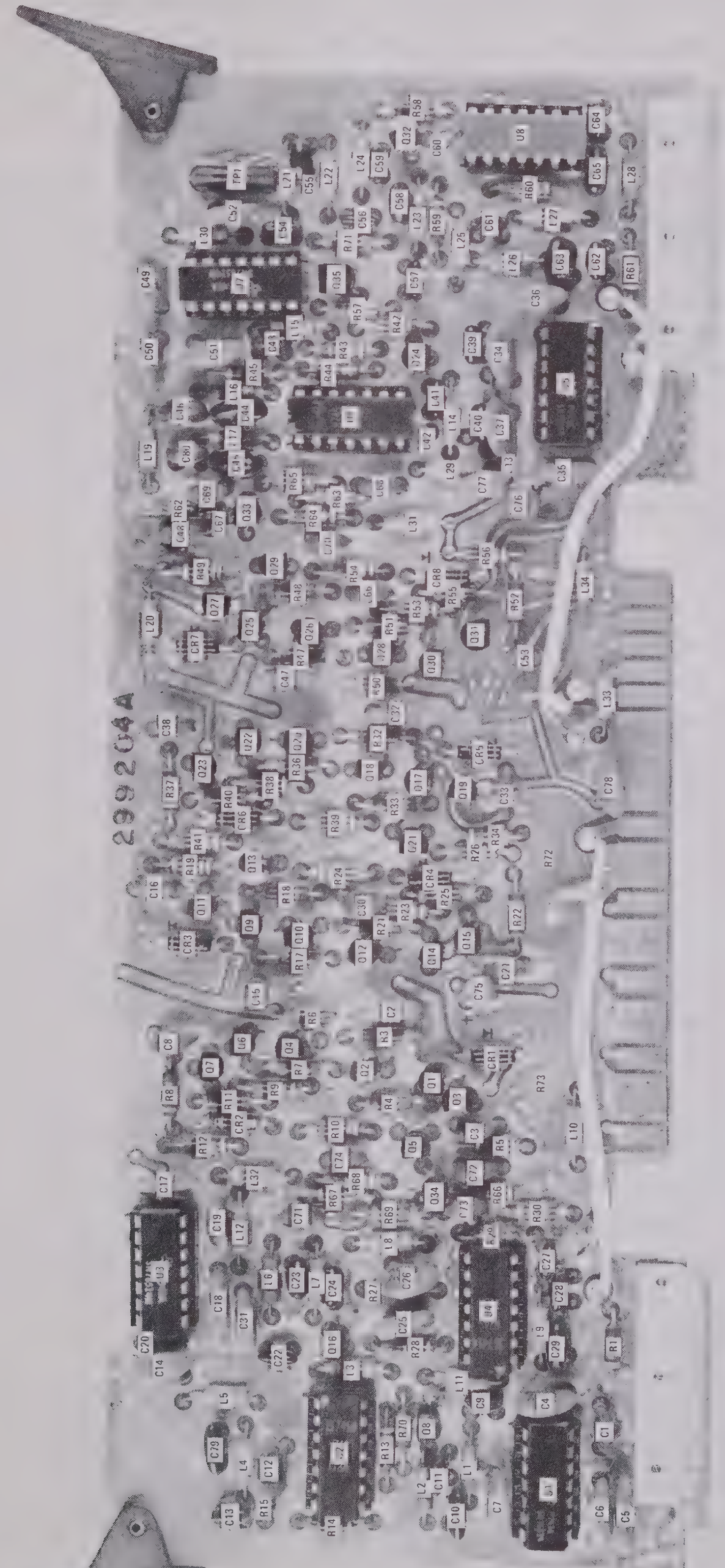


Figure 6-23. 1-kHz Decade Board A2A1, Component Locations

6-84. BCD-8 (NO. 1) BOARD A4A4. (Figures 6-27 and 6-31). The 19.25-20.25 MHz signal from A4A3 is applied to A4A4 at E1 and is filtered by lowpass filter C1, C2, L1 and attenuator R1, R2, and R3. The signal is applied to mixer M1 where it mixes with 64 or 65 MHz from BCD-8 switch A4A10. The lower sideband from the mixer is selected by the 43.75 to 45.0 MHz bandpass filter formed by C3 through C8 and L2 through L8. This signal is amplified to a level of -5 dBm and applied to BCD-8 (No. 2) board A4A5.

6-85. BCD-8 (NO. 2) BOARD A4A5. (Figures 6-32 and 6-33). The 43.75- to 45.0-MHz input signal from A4A4 is filtered by the bandpass filter formed by C1 through C4, and L1-L3 and amplified by Q1 to a level sufficient to drive U1. U1 is a frequency divide-by-5 circuit producing an output equal to one fifth the input or 8.75 to 9.0 MHz. This signal is amplified and passed through a 250 kHz bandwidth filter consisting of C13 through C21 and L7 through L13. The output of this filter is multiplied by 4 in the multiplier section consisting of Q3 and Q4. C27 through C31, L15 through L18, and L25 form a bandpass filter at the 35- to 36-MHz output frequency to reject the 8.75- to 9.0-MHz sidebands of the multiplier. The 35- to 36-MHz signal is amplified in transistor stage Q5 and passed through a lowpass filter (C35, C36, L19) and attenuator (R20, R21, and R22) to produce an output signal about -2 dBm. This signal is the final output of the mainframe.

6-86. BUFFER AMPLIFIER A4A6. (Figures 6-34 and 6-35). The 64- and 65-MHz inputs at J2 and J4 are amplified by transistor stages Q1 and Q2, respectively. The output of Q1 is filtered by a 64-MHz filter consisting of C4 through C7 and L3 through L5 and connects to the 64-MHz input of 10 KHz BCD board A4A11 through a 3-dB attenuator comprising R7, R8, and R9. The output of Q2 is filtered by a 65-MHz filter consisting of C13 through C16 and L9 through L11 and passed through a 3-dB attenuator comprising R16, R17, and R18. This signal becomes the 65-MHz input to 10 kHz BCD board A4A11.

6-87. 64/65 MHz SWITCHES A4A7 THROUGH A4A10. (Figures 6-34 and 6-36). The 64/65 MHz switches (A4A7, A4A8, A4A9, and A4A10) select 64 or 65 MHz for each of the higher order BCD boards A4A1, A4A2, A4A3, and A4A4, respectively. The input level is about 200 mV rms (0 dBm into 50 ohms). The logic input at E3 is a TTL compatible level where a high level selects the B input at E2 and a low level selects the A input at E1. When a low level is applied at E3, Q7 goes on and turns Q8 off. With Q7 on, CR2 if forward biased and Q4 and Q5 are reversed biased thereby isolating the "B" input at E2. With Q8 off, CR1 is biased off and Q1 and Q2 are biased on. Q1 and Q2 amplify the "A" input and apply it to buffer amplifier Q3. The signal from Q3 is further amplified in Q9 and passed through a 64- to 65-MHz band-pass filter consisting of C11 through C14, and L5 through L7. The output of this filter is at a level of +7 dBm and drives the LO input to the mixer. When a "high" level is applied at E3, Q7 goes off and turns Q8 on. With Q8 on, CR1 is biased on, and Q1 and Q2 are biased off thereby isolating the "A" input at E1. With Q7 off, Q4 and Q5 are biased on and CR2 is biased off thereby amplifying the "B" input and connecting it to the buffer Q3 as described above.

6-88. 10 kHz BCD BOARD A4A11. (Figures 6-37 and 6-38). The input to 10 kHz BCD board A4A11 is a 35- to 36-MHz signal at -5 dBm, from lower order BCD assembly A2. This signal is mixed in the BCD-1 mixer with 64 or 65 MHz as selected by the BCD-1 switch (Q5 through Q11 and Q1). The level out of all the switches measured at the mixer LO input is +7 dBm nominal. The 28 to 30 MHz bandpass filter

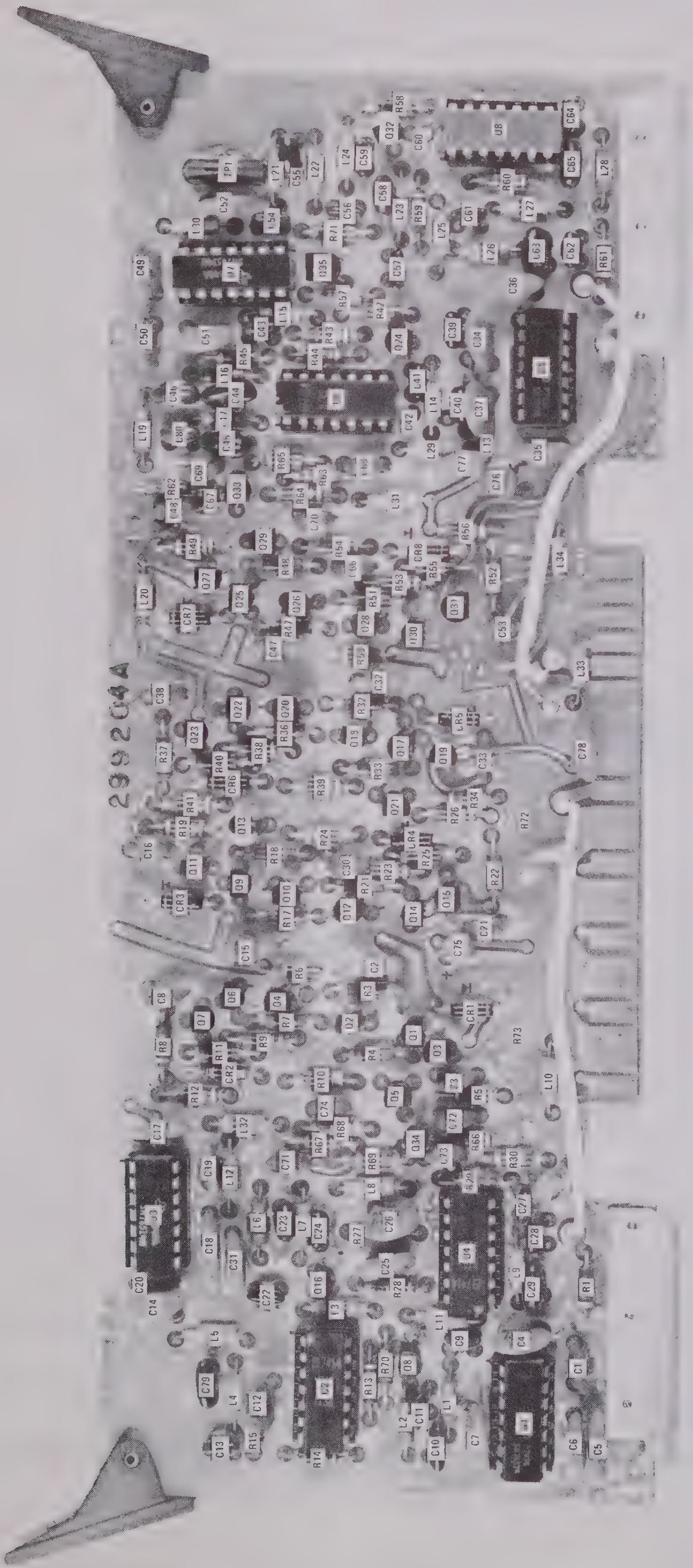


Figure 6-23. 1-kHz Decade Board A2A1, Component Locations

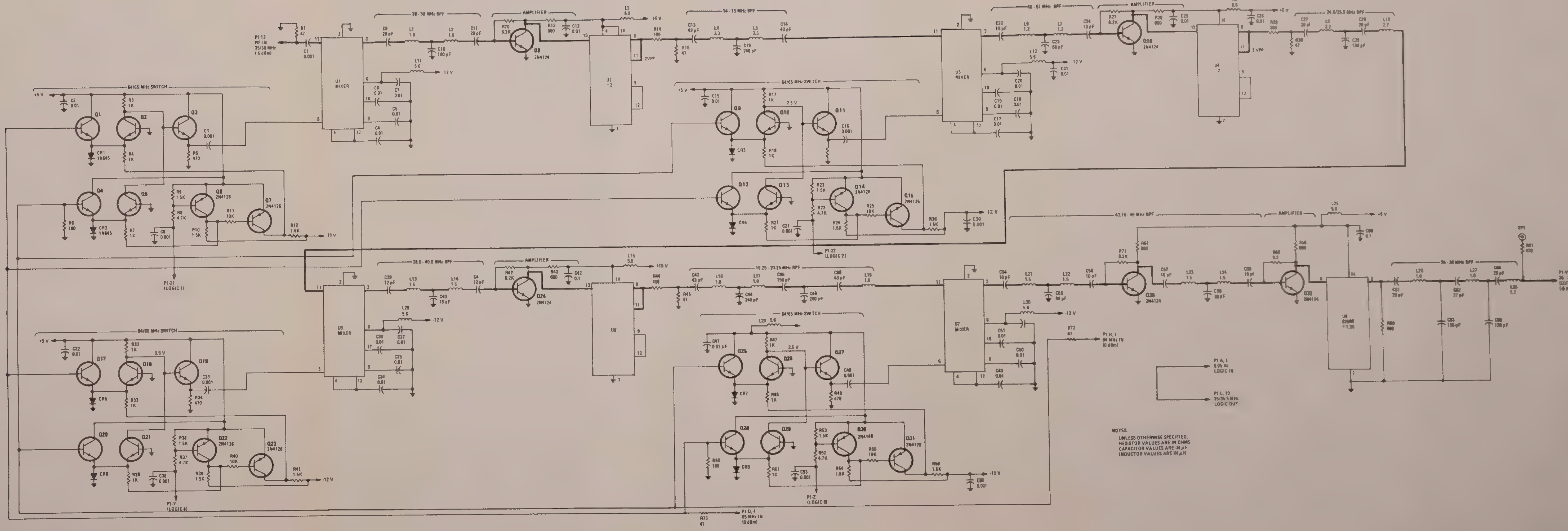
6-84. BCD-8 (NO. 1) BOARD A4A4. (Figures 6-27 and 6-31). The 19.25-20.25 MHz signal from A4A3 is applied to A4A4 at E1 and is filtered by lowpass filter C1, C2, L1 and attenuator R1, R2, and R3. The signal is applied to mixer M1 where it mixes with 64 or 65 MHz from BCD-8 switch A4A10. The lower sideband from the mixer is selected by the 43.75 to 45.0 MHz bandpass filter formed by C3 through C8 and L2 through L8. This signal is amplified to a level of -5 dBm and applied to BCD-8 (No. 2) board A4A5.

6-85. BCD-8 (NO. 2) BOARD A4A5. (Figures 6-32 and 6-33). The 43.75- to 45.0-MHz input signal from A4A4 is filtered by the bandpass filter formed by C1 through C4, and L1-L3 and amplified by Q1 to a level sufficient to drive U1. U1 is a frequency divide-by-5 circuit producing an output equal to one fifth the input or 8.75 to 9.0 MHz. This signal is amplified and passed through a 250 kHz bandwidth filter consisting of C13 through C21 and L7 through L13. The output of this filter is multiplied by 4 in the multiplier section consisting of Q3 and Q4. C27 through C31, L15 through L18, and L25 form a bandpass filter at the 35- to 36-MHz output frequency to reject the 8.75- to 9.0-MHz sidebands of the multiplier. The 35- to 36-MHz signal is amplified in transistor stage Q5 and passed through a lowpass filter (C35, C36, L19) and attenuator (R20, R21, and R22) to produce an output signal about -2 dBm. This signal is the final output of the mainframe.

6-86. BUFFER AMPLIFIER A4A6. (Figures 6-34 and 6-35). The 64- and 65-MHz inputs at J2 and J4 are amplified by transistor stages Q1 and Q2, respectively. The output of Q1 is filtered by a 64-MHz filter consisting of C4 through C7 and L3 through L5 and connects to the 64-MHz input of 10 KHz BCD board A4A11 through a 3-dB attenuator comprising R7, R8, and R9. The output of Q2 is filtered by a 65-MHz filter consisting of C13 through C16 and L9 through L11 and passed through a 3-dB attenuator comprising R16, R17, and R18. This signal becomes the 65-MHz input to 10 kHz BCD board A4A11.

6-87. 64/65 MHz SWITCHES A4A7 THROUGH A4A10. (Figures 6-34 and 6-36). The 64/65 MHz switches (A4A7, A4A8, A4A9, and A4A10) select 64 or 65 MHz for each of the higher order BCD boards A4A1, A4A2, A4A3, and A4A4, respectively. The input level is about 200 mV rms (0 dBm into 50 ohms). The logic input at E3 is a TTL compatible level where a high level selects the B input at E2 and a low level selects the A input at E1. When a low level is applied at E3, Q7 goes on and turns Q8 off. With Q7 on, CR2 if forward biased and Q4 and Q5 are reversed biased thereby isolating the "B" input at E2. With Q8 off, CR1 is biased off and Q1 and Q2 are biased on. Q1 and Q2 amplify the "A" input and apply it to buffer amplifier Q3. The signal from Q3 is further amplified in Q9 and passed through a 64- to 65-MHz band-pass filter consisting of C11 through C14, and L5 through L7. The output of this filter is at a level of +7 dBm and drives the LO input to the mixer. When a "high" level is applied at E3, Q7 goes off and turns Q8 on. With Q8 on, CR1 is biased on, and Q1 and Q2 are biased off thereby isolating the "A" input at E1. With Q7 off, Q4 and Q5 are biased on and CR2 is biased off thereby amplifying the "B" input and connecting it to the buffer Q3 as described above.

6-88. 10 kHz BCD BOARD A4A11. (Figures 6-37 and 6-38). The input to 10 kHz BCD board A4A11 is a 35- to 36-MHz signal at -5 dBm, from lower order BCD assembly A2. This signal is mixed in the BCD-1 mixer with 64 or 65 MHz as selected by the BCD-1 switch (Q5 through Q11 and Q1). The level out of all the switches measured at the mixer LO input is +7 dBm nominal. The 28 to 30 MHz bandpass filter



NOTES:
UNLESS OTHERWISE SPECIFIED,
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN µF
INDUCTOR VALUES ARE IN µH

Figure 6-24. 0.1 to 100 Hz BCD Decade Boards A2A2-A2A5, Schematic Diagram

consisting of L3, L4, C4, C5, and C6 selects the lower sideband of the BCD-1 mixer. This signal is amplified by driver Q2 to a level of 2V peak-to-peak centered at +1.2V and is applied to U1 pin 13. U1 is frequency divide-by-2 circuit which has an output of 14 to 15 MHz at 2.5 V peak-to-peak. This signal is filtered by a 14 to 15 MHz bandpass filter consisting of L6, L7, C8, C9, and C10 and applied to the RF input of the BCD-2 mixer.

6-89. BCD-2 mixer M2 mixes the 14- to 15-MHz signal with 64 or 65 MHz from the BCD-2 switch which consists of Q3, and Q12 through Q18. The lower sideband, or difference frequency, is selected by a 49 to 51 MHz bandpass filter consisting of L10, L11, C12, C15, and C16. This filtered signal is amplified by driver Q4 to a level of 1.6V peak-to-peak centered on 1.2V and applied to flip-flop U2 which functions as a frequency divide-by-2 circuit. The output of U2 is 24.5 to 25.5 MHz which is filtered by the bandpass filter formed by C19, C20, C21, L13, and L14.

6-90. BCD-4 mixer M3 heterodynes this signal, which is at a level of 0.6V peak-to-peak, with the output of the BCD-4 switch consisting of Q24 through Q30 and Q19. The lower sideband of the 38.5 to 40.5 MHz, is selected by the bandpass filter formed by C32, C34, C35, L21 and L22. This signal is amplified by transistor driver Q20 and applied to U3 at a level of 2V peak-to-peak centered at 1.1V. Flip-flop U3 functions as a frequency divide-by-two circuit. The output of this circuit is filtered by the 19.25 to 20.25 MHz bandpass filter formed by C37 through C41, L24, L25, and L26. This signal is applied to the BCD-8 mixer at a level of 0.4V peak-to-peak.

6-91. BCD-8 mixer M4 mixes the 19.25 to 20.25 MHz signal with the output of the BCD-8 switch which consists of Q31 through Q37 and Q21. The output of M4 is filtered by C43, C46, C47, L27, and L30 which selects the lower sideband, 43.75 to 45.0 MHz. This signal is amplified in Q22 and filtered by an identical filter C48, C49, C50, L31, and L32 for more rejection. The filtered signal is amplified by transistor driver Q23 and applied to U4 at a level of 1.6V peak-to-peak centered at 1V. U4 is a decade counter connected as a frequency divide-by-five circuit. Due to the fast rise times on the output of U4, the output signal is rich in harmonics. The fourth harmonic is selected by a 35 to 36 MHz filter consisting of C52 through C56, L34, L35, and L36. The output of this filter is the output of the board at a level of -5 dBm.

6-92. The 64- and 65-MHz inputs for the switches come from A4A6. In addition to being applied to the switches, these inputs are applied to buffer amplifiers and bandpass filters to isolate the lower order BCD assembly from the 10-kHz output. The 64-MHz buffer amplifier is Q38 and the filter is L43, L45, C67, C73, and C75. The 65-MHz buffer amplifier is Q39 and the filter is C70, C74, C78, L44 and L46. The output of both of these amplifiers is a 0 dBm.

6-93. FIXED FREQUENCY GENERATOR A5.

6-94. The fixed frequency generator (Figure 6-39) produces all the fixed reference frequencies required by the frequency synthesizer. The output frequencies are 10, 60, 64, 65, and 35 or 35.5 MHz. All of these signals are derived directly from the 5- or 10-MHz input by simple operations of multiplication, division, addition, and subtraction.

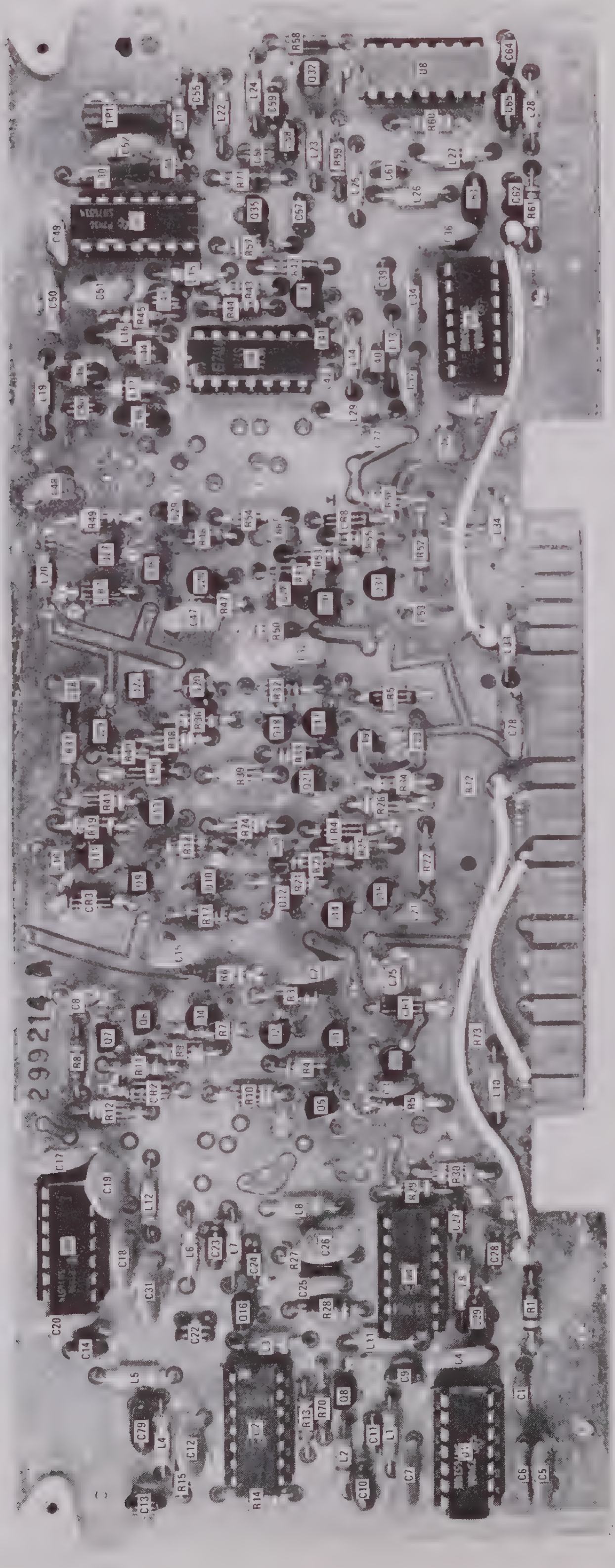


Figure 6-25. 0.1 to 100 Hz BCD Decade Boards A2A2-A2A5, Component Locations

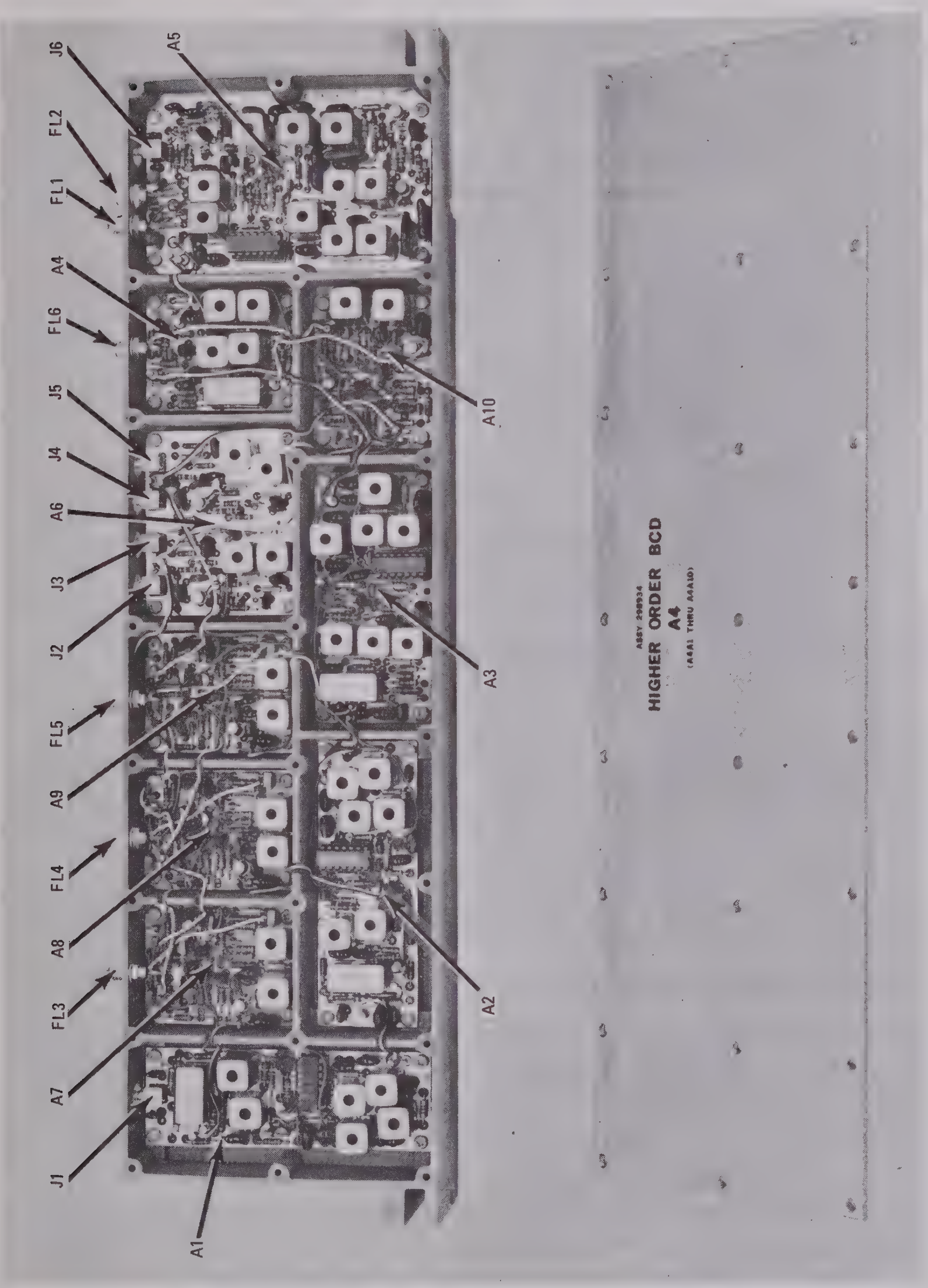


Figure 6-26. Higher Order BCD Assembly A4

6-95. **FIXED FREQUENCY INPUT BOARD A5A1.** (Figures 6-40 and 6-41). The input to this board is from the REF IN connector at the rear panel of the frequency synthesizer. The input signal is 5 or 10 MHz at a level of 0 dBm minimum. This signal goes through saturated amplifier Q1 which limits the 10 MHz or produces harmonics of 5 MHz. C4, L1, C6, L2, and C7 form a 10 MHz bandpass filter which selects the correct harmonic (10 MHz) of the input signal. The 10-MHz signal is further amplified by Q2 and filtered by 4-pole bandpass filter L3, L5, L6, and L8. The output of this filter is amplified again and passed through crystal filter Y1 which reduces excess noise on the reference by 20 dB for noise sidebands greater than 500 Hz away from the carrier. The output of this board is 0 dBm into 50 ohms. The 10-MHz signal drives all the other units in the fixed frequency generator.

6-96. **10 MHz OUTPUT AMPLIFIER A5A2.** (Figures 6-40 and 6-42). This printed circuit board buffers the 10-MHz signal. One buffered output at A5J2 provides 10 MHz at +3 dBm for the RF plug-in unit. The other output at A5J3 provides a 10-MHz reference output at +3 dBm at the rear panel of the frequency synthesizer. The board consists of two amplifiers, Q1 and Q2, and two, 10-MHz bandpass filters: L1, L2, C1, C2, and C3; and L4, L5, C6, C7, and C8.

6-97. **60 MHz GENERATOR A5A3.** (Figures 6-40 and 6-43). The 60 MHz generator provides a 60-MHz output at +5 dBm. The 10-MHz signal from fixed frequency input board A5A1 is amplified by Q1. Transistor Q2 is a saturated amplifier stage followed by 60-MHz, four-pole bandpass filter L3 through L6. The combination of the saturated amplifier and bandpass filter form a X6 multiplier. The output of the bandpass filter is a 60-MHz signal which is amplified by Q3 and filtered by 60-MHz bandpass filter L9, L10, C13, C19, and C20. The output of A5A3 is a +5 dBm signal at 60 MHz for use in the frequency extender module.

6-98. **65 MHz GENERATOR A5A4.** (Figures 6-44 and 6-45). The input to the 65 MHz generator is 10 MHz from fixed frequency input board A5A1. This signal is amplified by amplifier Q1. Transistor Q2 is a class C amplifier which produces a 10-MHz signal rich in harmonics. The 13th harmonic, 130 MHz, is selected by four-pole bandpass filter L4 through L7 and C8 through C13 and C15 and C16. The 130-MHz signal is amplified by Q3 which forms a driver stage for U1 - a high speed flip-flop operating as a frequency divide-by-two circuit producing 65 MHz. The 65 MHz is amplified by Q4 and filtered by five-pole bandpass filter L14 through L18 and C24 through C34. The 65-MHz output at 0 dBm minimum provides one of the reference frequencies required for the BCD section.

6-99. **64 MHz GENERATOR A5A5.** (Figures 6-46 and 6-47). The 64 MHz generator starts with 10 MHz from fixed frequency input board A5A1 and amplifies the 10 MHz in Q1. Transistor Q2 is a saturated amplifier stage which produces harmonics of 10 MHz. The eighth harmonic (80 MHz) is selected by five-pole bandpass filter L5 through L9, C5, and C8 through C16. The output of this filter is 80-MHz signal which is amplified by Q3 (part of a driver for U1 and U2). U1 and U2 are Schottky TTL flip-flops connected to form a frequency divide-by-five circuit. The output at U2 pin 6 is a 16-MHz signal rich in harmonics due to the fast rise times of the Schottky TTL logic. L12, L13, C19, C20, and C21 form a bandpass filter selecting the fourth harmonic (64 MHz) which is amplified by Q4. L16 through L20 and C25 through C34 form a five-pole bandpass filter at 64 MHz which filters out sidebands from the divider. The output of this filter is 64 MHz at 0 dBm minimum which is one of the reference frequencies used in the BCD section.

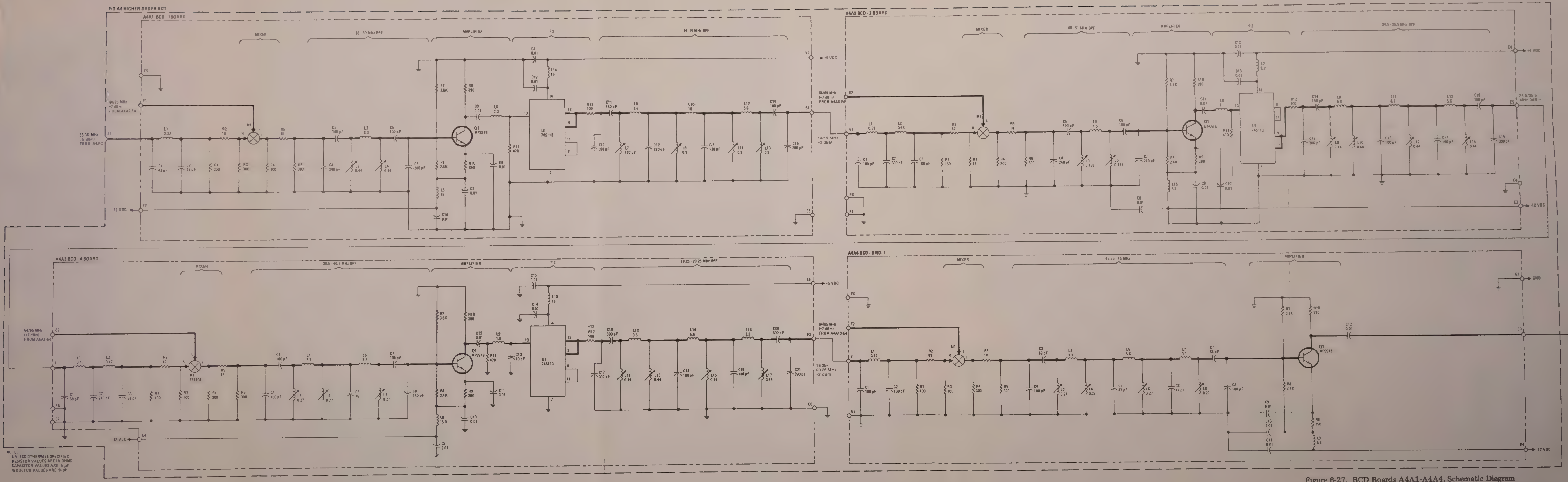


Figure 6-27. BCD Boards A4A1-A4A4, Schematic Diagram

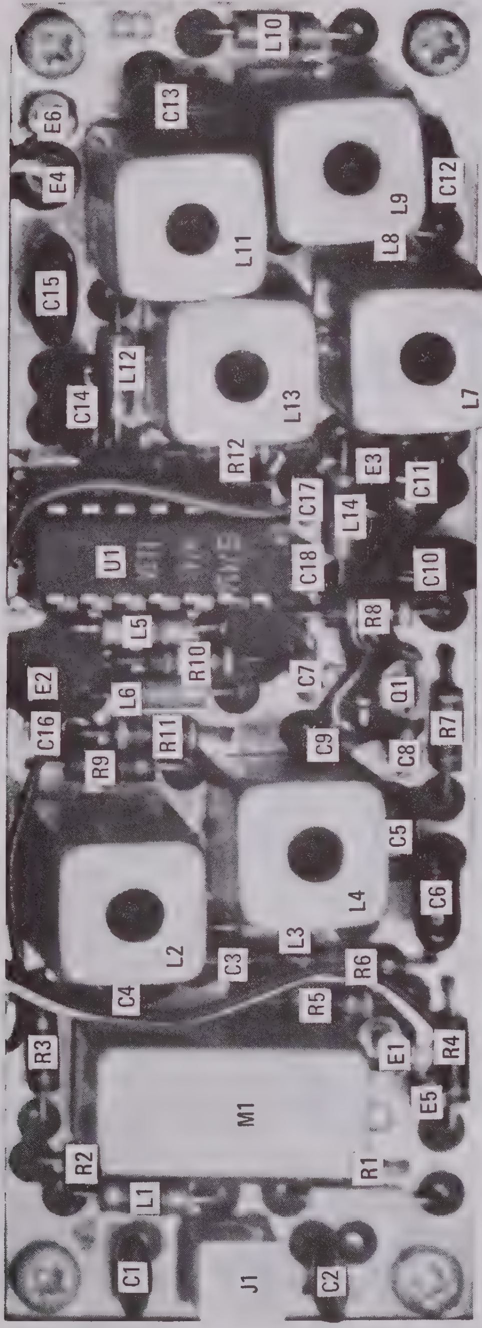


Figure 6-28. BCD-1 Board A4A1, Component Locations

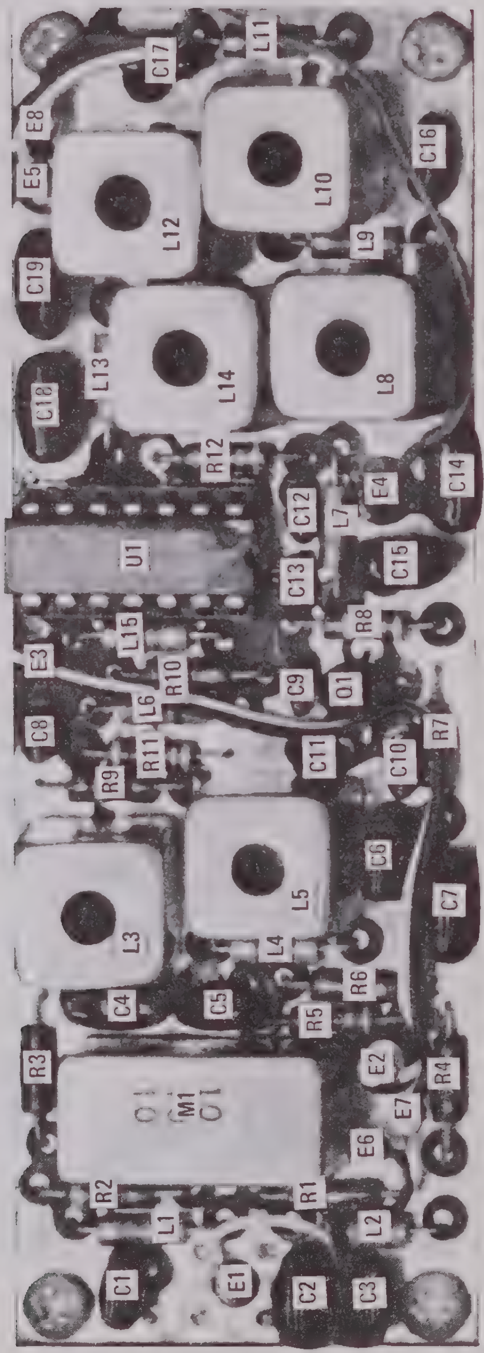


Figure 6-29. BCD-2 Board A4A2, Component Locations

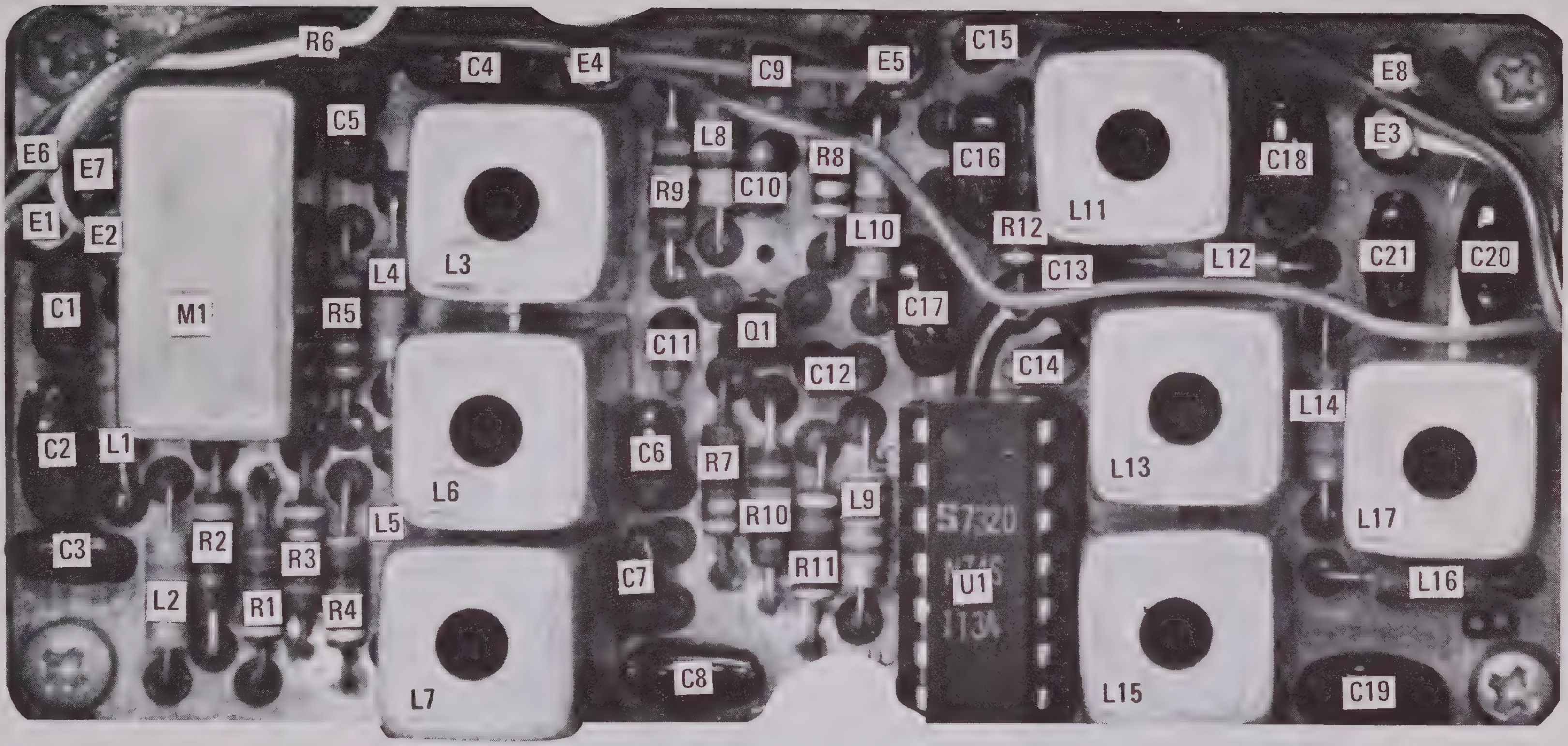


Figure 6-30. BCD-4 Board A4A3, Component Locations

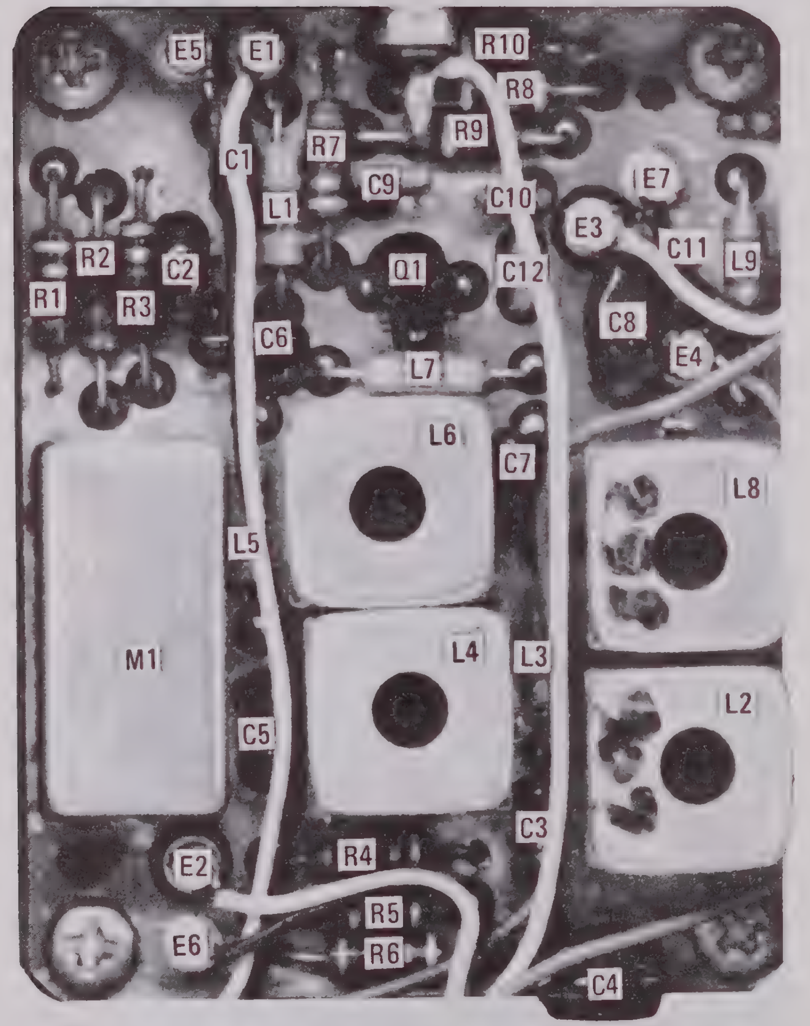
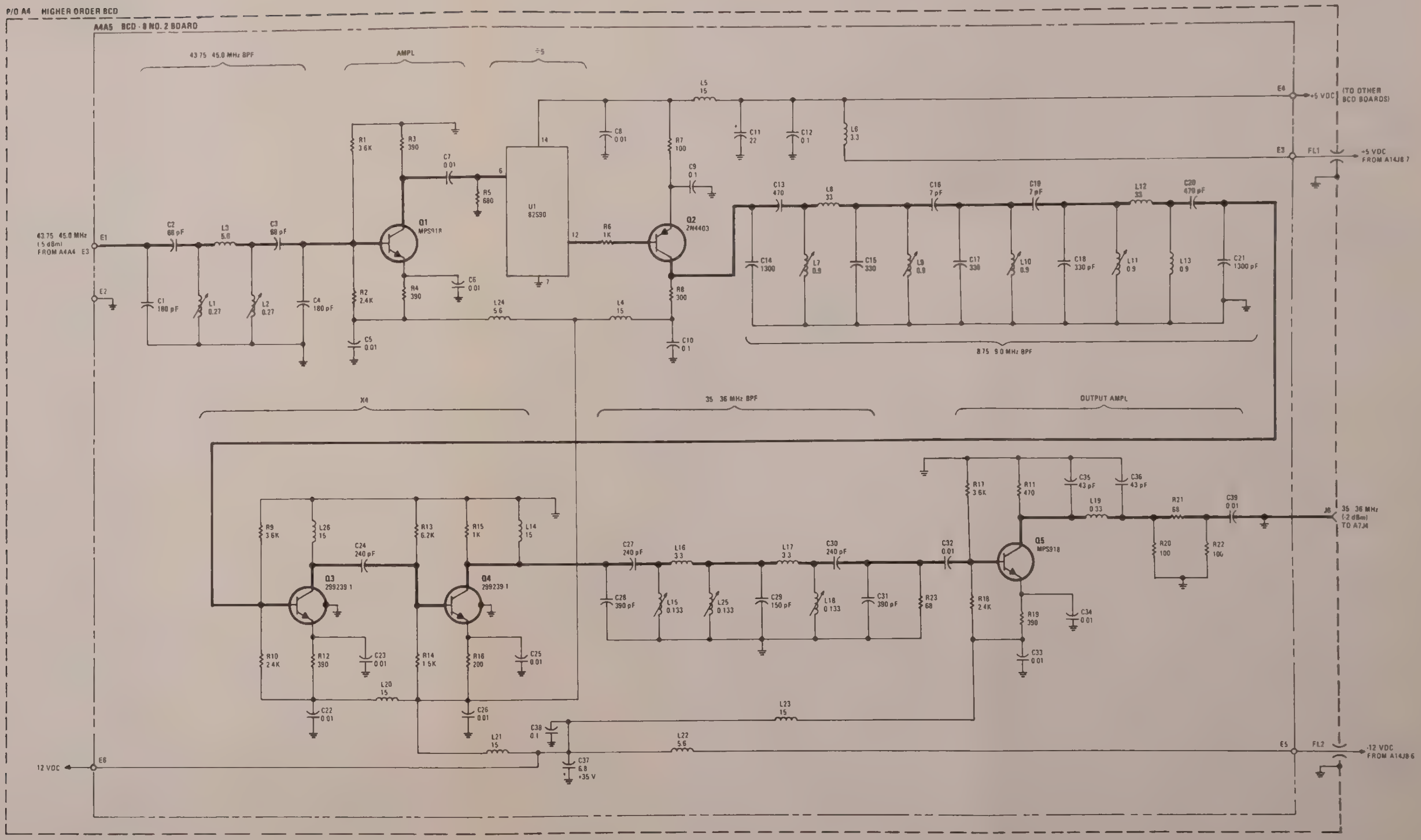


Figure 6-31. BCD-8-1 Board A4A4, Component Locations



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-32. BCD-8 Board A4A5, Schematic Diagram

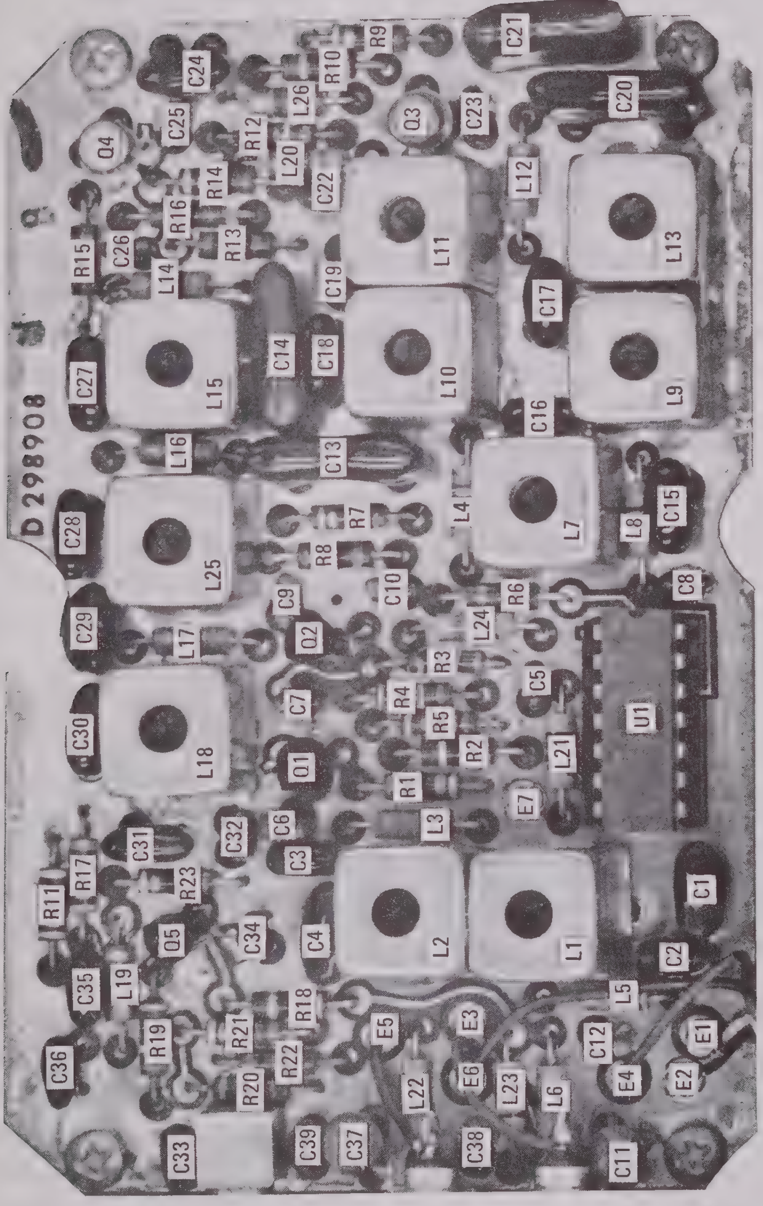


Figure 6-33. BCD-8-2 Board A4A5, Component Locations

6-100. 35/35.5 MHz BOARD A5A6. (Figures 6-46 and 6-48). The third reference frequency required by the BCD section is 35.0 or 35.5 MHz. The output frequency is switched with a TTL compatible command at A5FL3. A logic 0 ($\leq$ 0.8V) produces 35.0 MHz and a logic 1 ($\geq$ 2.2V) produces 35.5 MHz at the output. With A5FL3 at logic 0, 10 MHz from fixed frequency input board A5A1 is amplified in saturated transistor Q1 which generates a 10-MHz signal rich in harmonics. The seventh harmonic (70 MHz) is selected by the 70-MHz bandpass filter C2, C5, C6, L1, and L2. This 70-MHz signal is amplified by amplifier Q2 and filtered by 70-MHz bandpass filter L3, C9, C10, L5, and C11. The 70 MHz signal is applied to driver stage Q3 which drives U1. U1 is a Schottky TTL flip-flop operating as a frequency divide-by-two circuit producing 35 MHz. The 35 MHz passes through RF switch Q8 and CR1. Q8 is conducting and CR1 is reverse biased so that the 35-MHz signal appears as an output at A5J6. Note that U2 and the second half (U1B) of U1 are inhibited so that no other signals appear at the output.

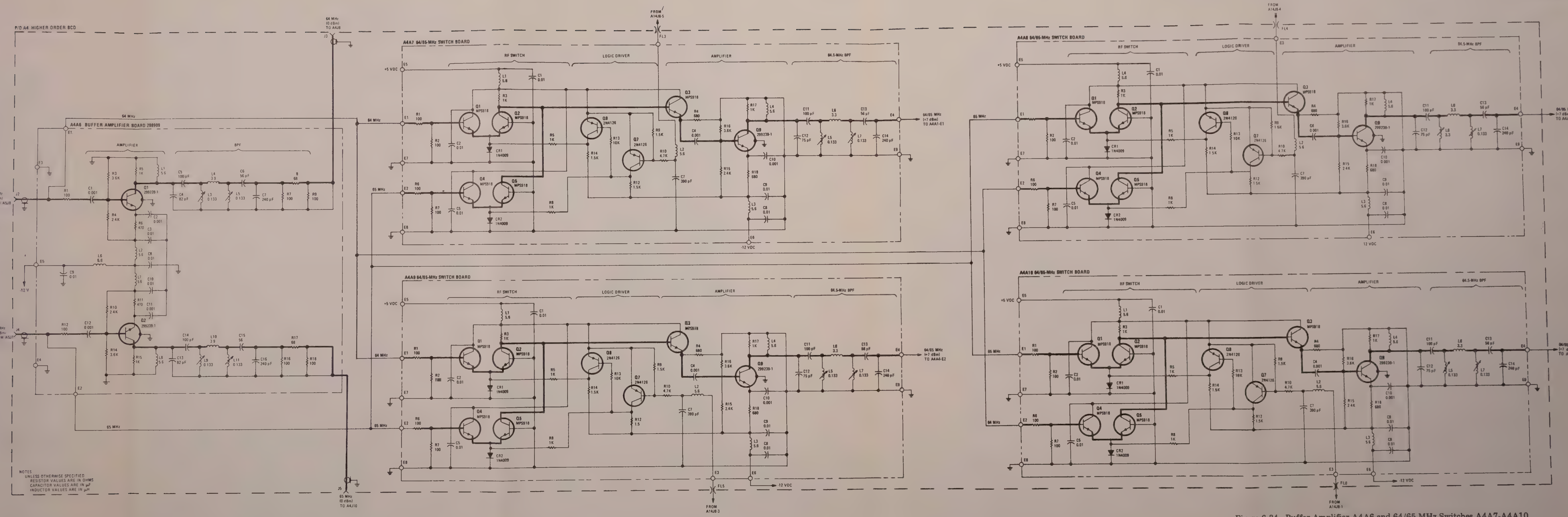
6-101. To generate 35.5 MHz, 64 MHz from A5A5 is amplified and isolated by amplifier stages Q4 and Q5 so that a buffered 64-MHz signal is applied to the base of Q6. A5FL3 is set at a logic 1 level which enables U2 and both halves of U1. A logic 1 also turns on CR1 and turns off Q8 so that 35 MHz is isolated from the output by more than 20 dB. The 35 MHz present at U1 pin 5 is connected to pin 8 of U2 which is a Schottky BCD counter functioning as a frequency divide-by-ten circuit producing a 3.5 MHz at U2 pin 12. This 3.5 MHz signal is applied to the base of Q6 alone with the 64-MHz signal causing Q6 to act as a mixer generating sum and difference products at 64 MHz and 3.5 MHz and its harmonics. The 71-MHz product is selected by 71-MHz bandpass filter L10, L11, C29, C30, and C31. This 71-MHz signal is amplified by driver Q7 and applied to U1 pin 13. U1 is a frequency divide-by-two circuit generating the required 35.5 MHz. The output of A5A6 is -5 dBm and all sidebands, not harmonically related, are 20 dB below the carrier. The output signal provides the input reference for the lower order BCD assembly.

6-102. POWER SUPPLY A11.

6-103. The power supply is a series-regulated, constant-voltage, low-noise supply. It has dual outputs of +5.2 Vdc at 5 amps and -12 Vdc at 4.5 amps. The power supply consists of four sections: most of rear panel assembly A12, part of front panel assembly A1, filter/regulator boards A11A1 through A11A3, and part of logic and power distribution board A14. The following paragraphs describe each of the sections that make up the power supply.

6-104. REAR PANEL ASSEMBLY A12. (Figures 6-49 and 6-50).

6-105. The input line voltage passes through the concom line filter/fuse/voltage selector. The built-in 120/240V selector and fuse allow protected operation on either of these line voltages. The hot line connection to the fan is passed through a relay on A12A1. When the system is on, the fan off input of this board is floating and the relay contact is in its normally closed position, thus applying ac power to the fan. When the system is switched to STBY, -12 volt is present, activating the relay and opening it's contact. At the output of transformer T1 are two 0.1 μF capacitors (C1 and C2) which are used to suppress transients. The transformer outputs are wired to two full wave bridges (BR1 and BR2) mounted on a heat sink of the rear panel. Transistors Q1 and Q2 are also located on the heat sink. An auxiliary power supply is



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN µF
INDUCTOR VALUES ARE IN µH

Figure 6-34. Buffer Amplifier A4A6 and 64/65 MHz Switches A4A7-A4A10, Schematic Diagram

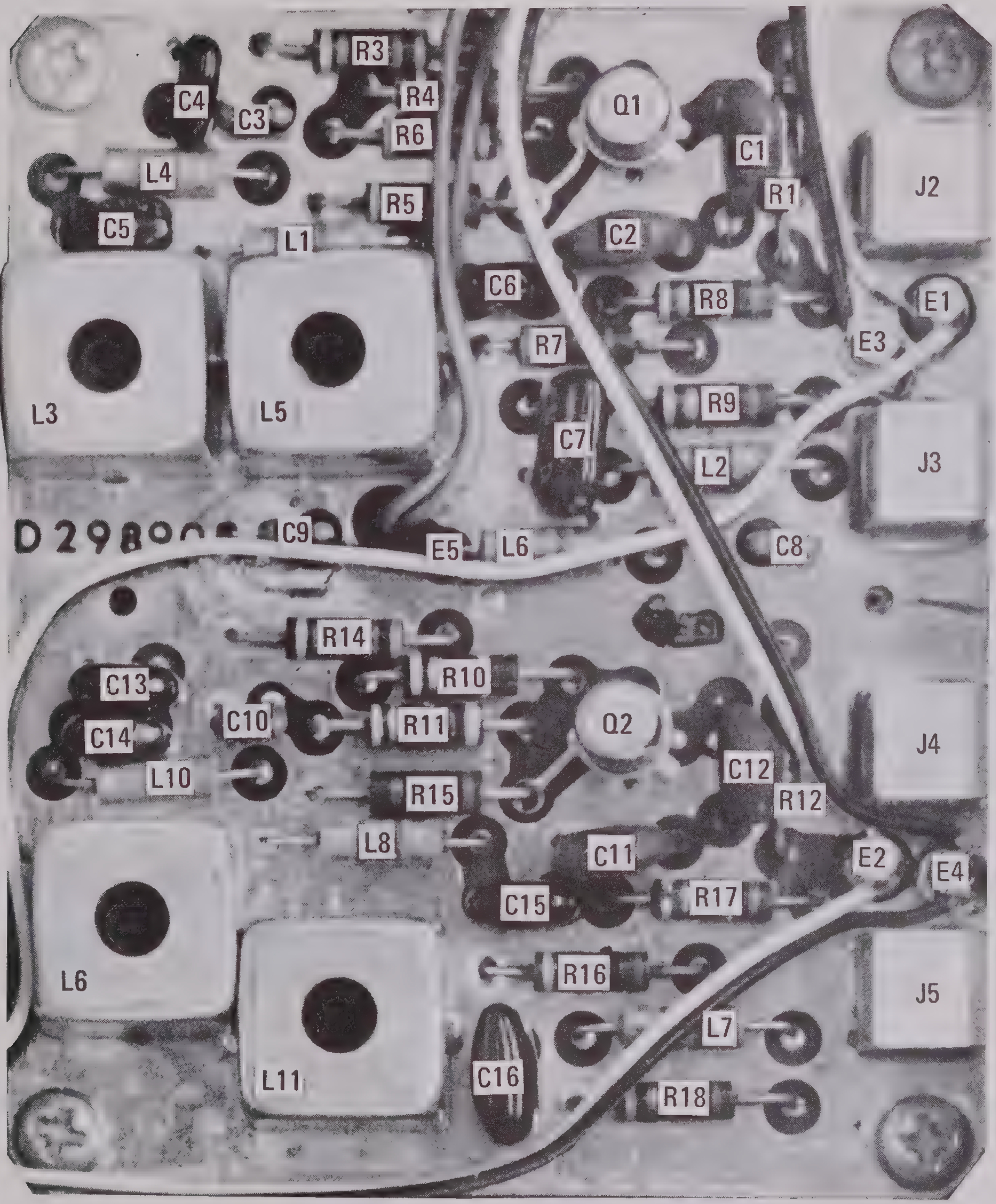


Figure 6-35. Buffer Amplifier A4A6, Component Locations

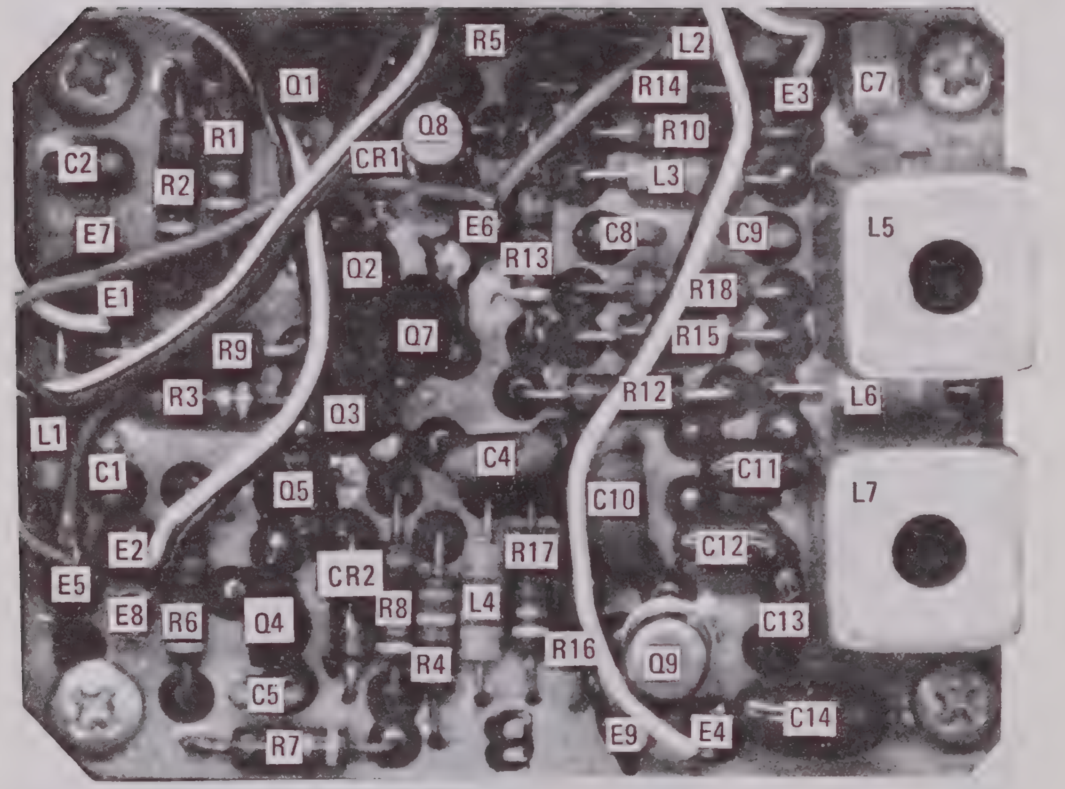
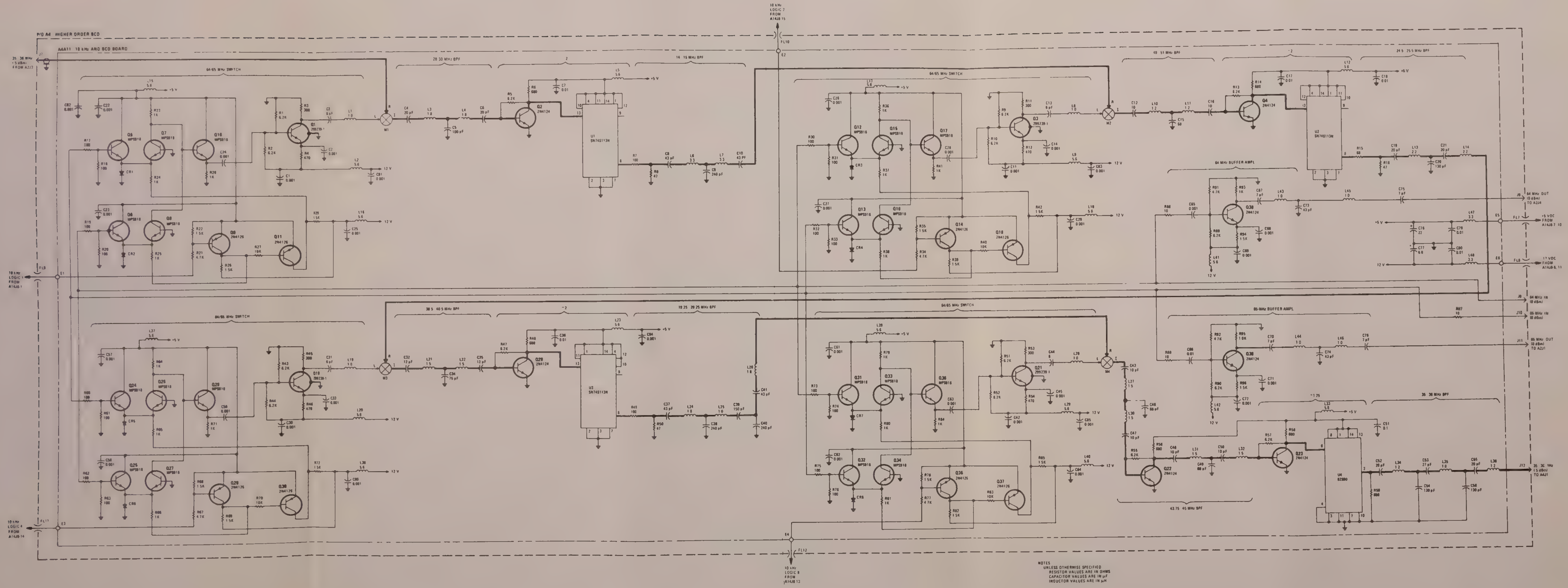


Figure 6-36. 64/65 MHz Switches A4A7-A4A10, Component Locations



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-37. 10 kHz BCD Board A4A11, Schematic Diagram

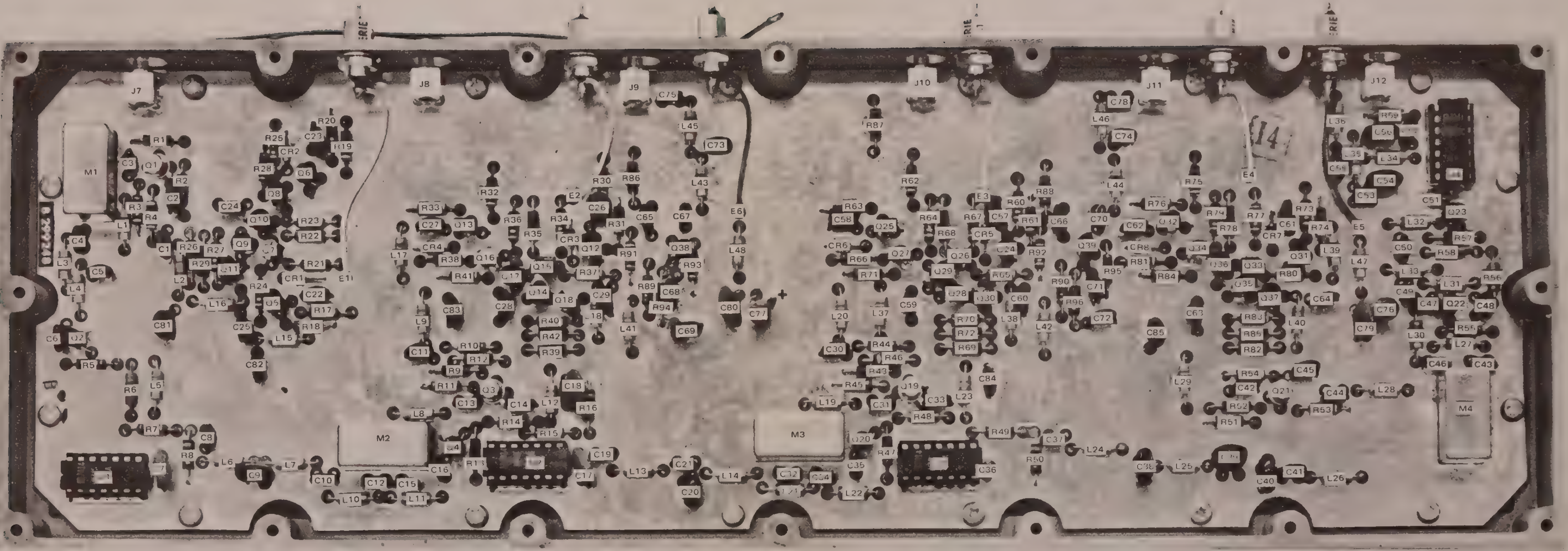


Figure 6-38. 10 kHz BCD Board A4A11, Component Locations

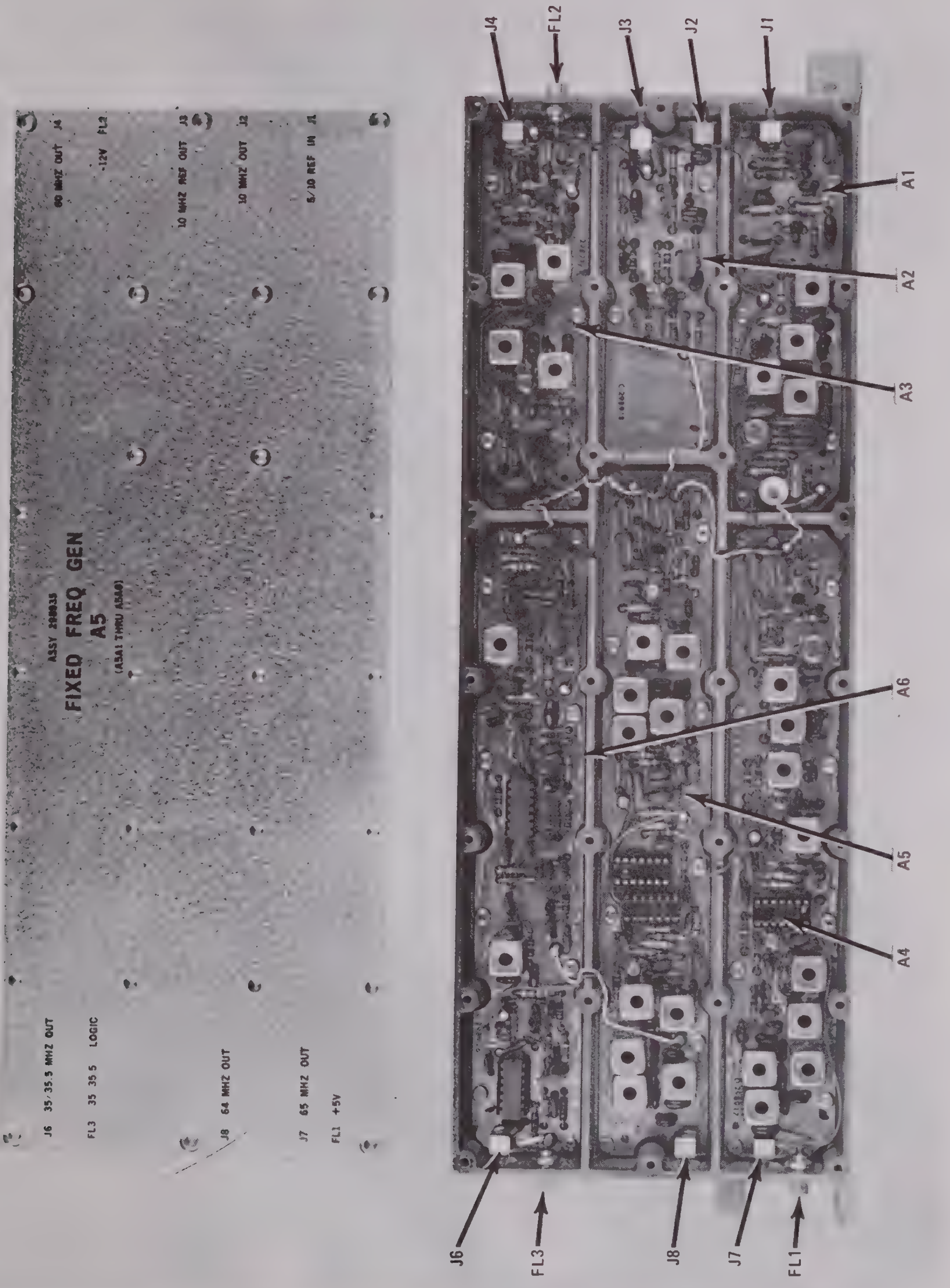
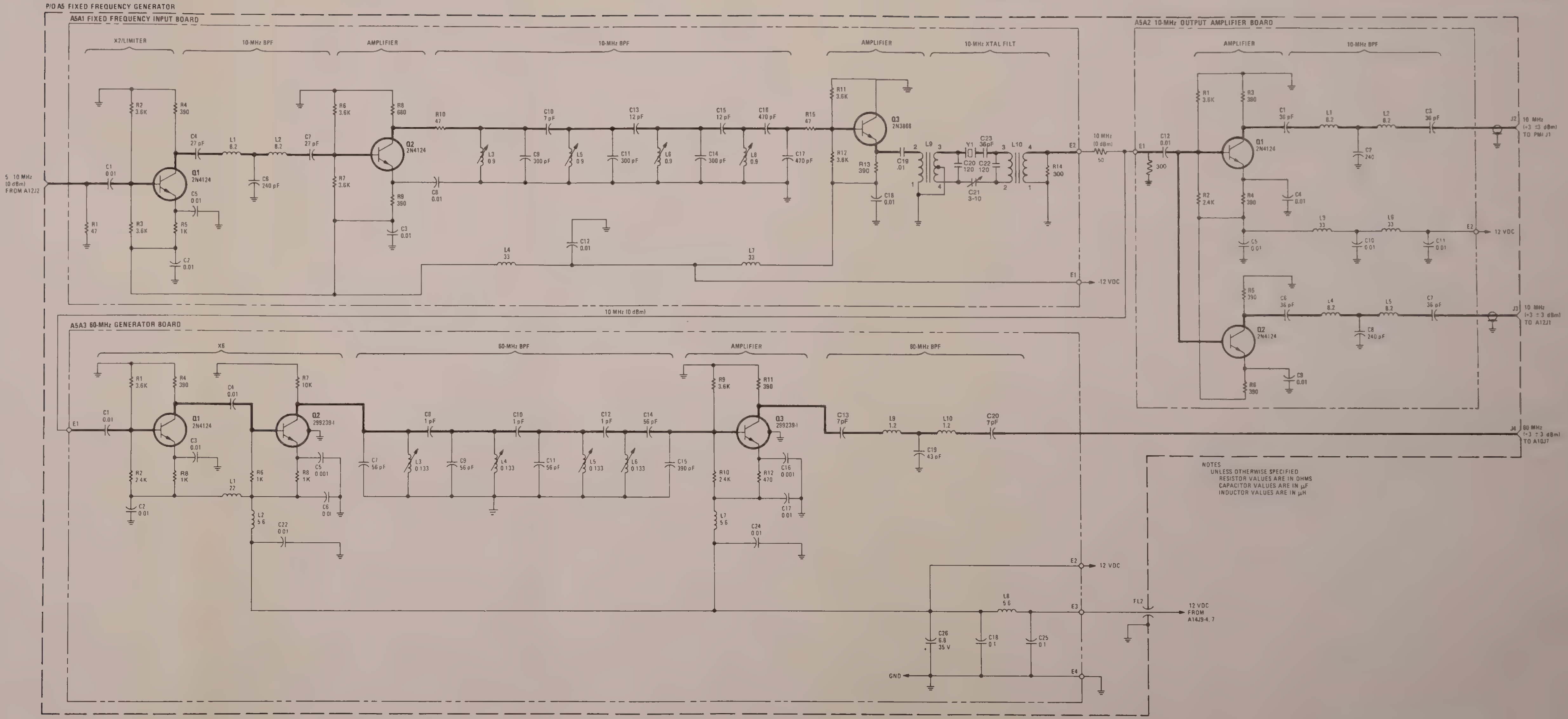


Figure 6-39. Fixed Frequency Generator A5



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-40. Fixed Frequency Input Board A5A1, 10 MHz Output Amplifier A5A2, and 60 MHz Generator A5A3, Schematic Diagram

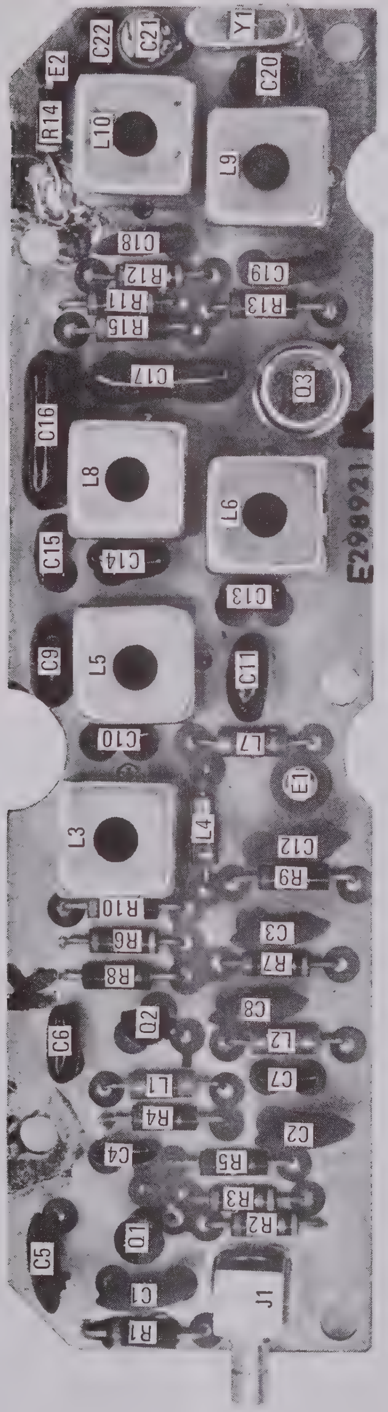


Figure 6-41. Fixed Frequency Input Board A5A1, Component Locations

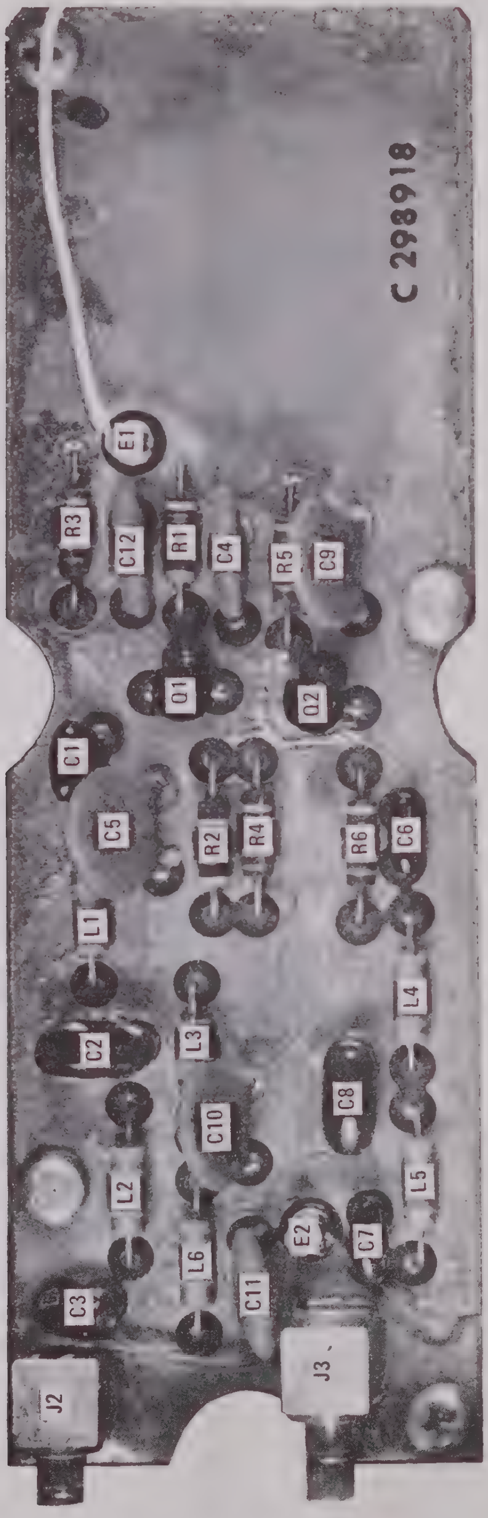


Figure 6-42. 10 MHz Output Amplifier A5A2, Component Locations

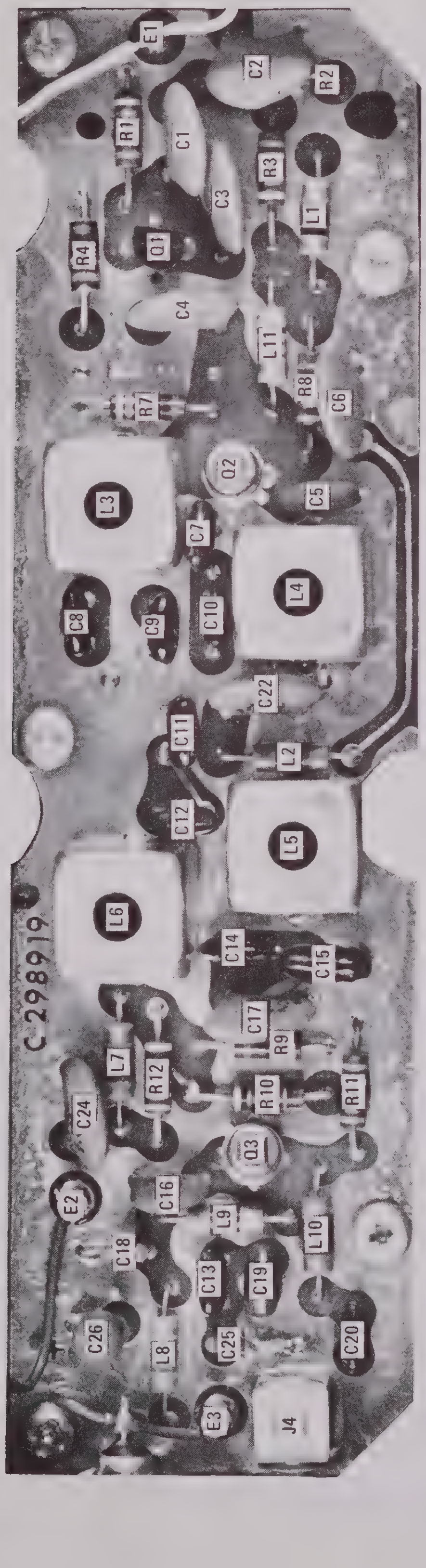
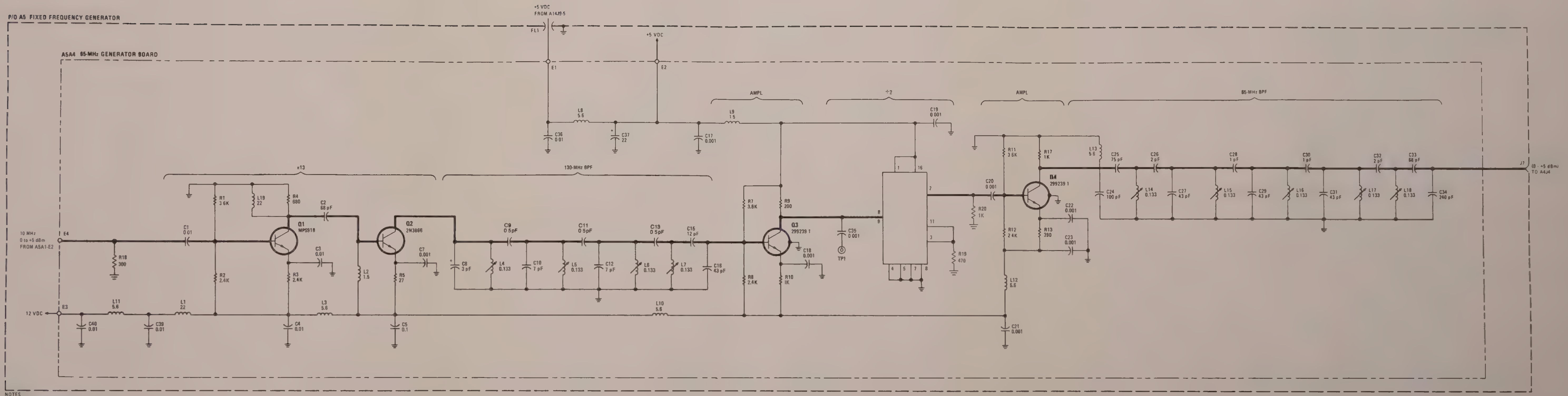


Figure 6-43. 60 MHz Generator A5A3, Component Locations



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-44. 65 MHz Generator A5A4, Schematic Diagram

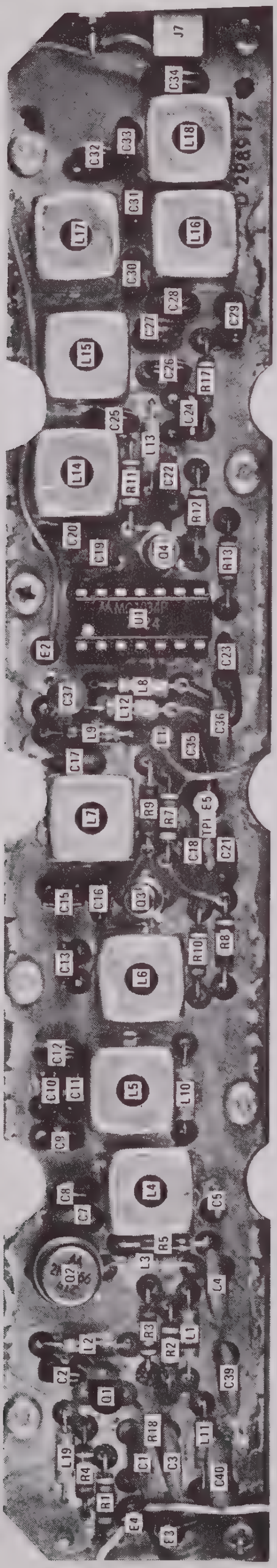
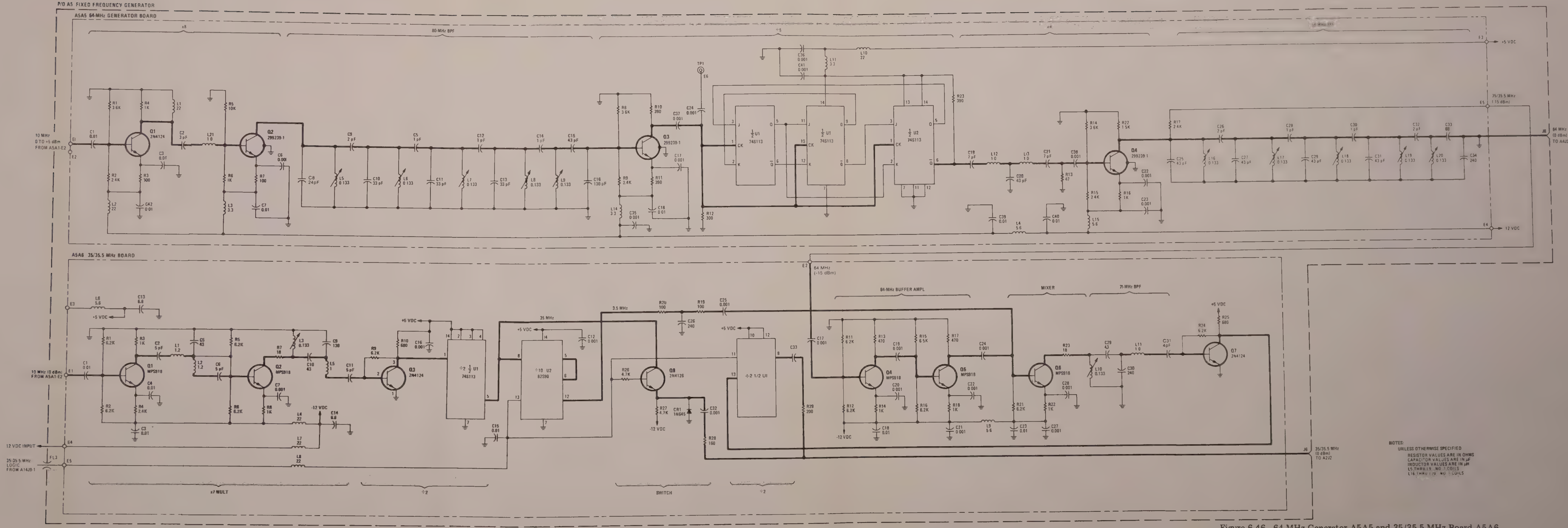


Figure 6-45. 65 MHz Generator A5A4, Component Locations



NOTES:
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH
L5 THRU L9 NO 1 COILS
L16 THRU L20 NO 1 COILS

Figure 6-46. 64 MHz Generator A5A5 and 35/35.5 MHz Board A5A6, Schematic Diagram

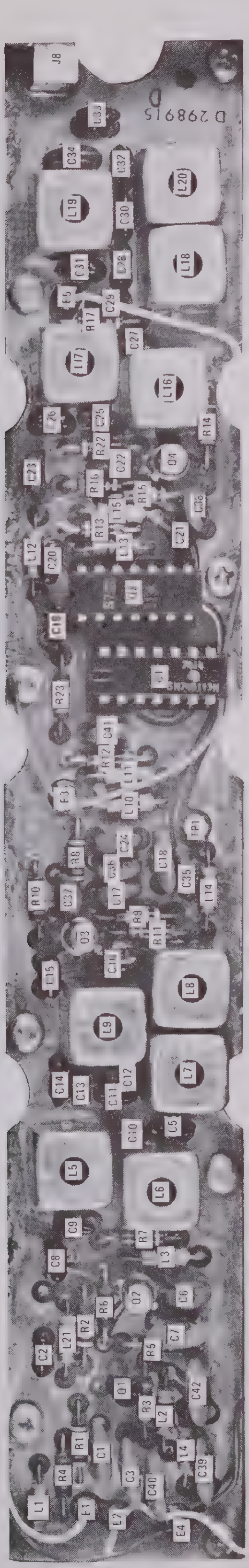


Figure 6-47. 64 MHz Generator A5A5, Component Locations

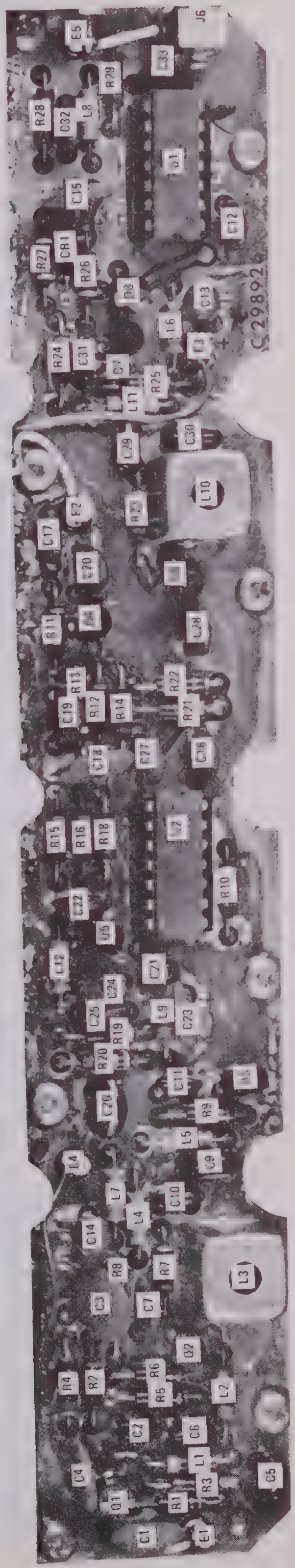
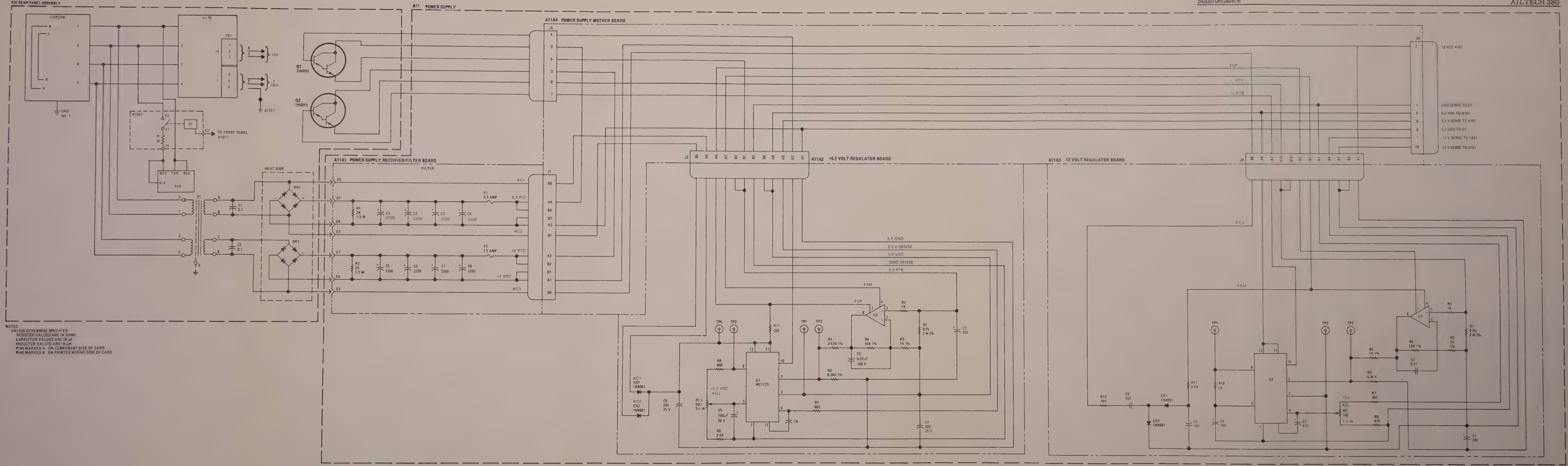
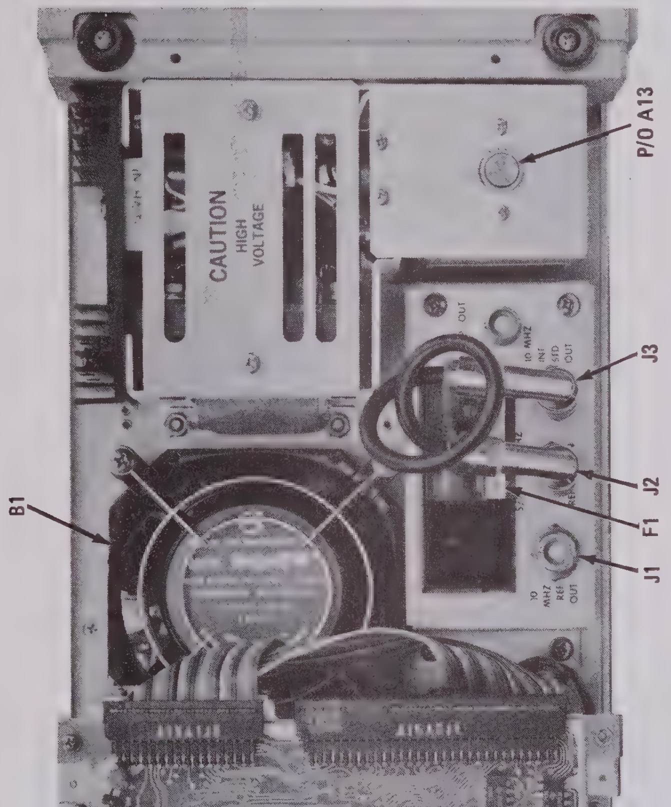


Figure 6-48. 35/35.5 MHz Board A5A6, Component Locations



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN µF
INDUCTOR VALUES ARE IN µH
PINS MARKED A - ON COMPONENT SIDE OF CARD
PINS MARKED B ON PRINTED WIRING SIDE OF CARD

Figure 6-49. Rear Panel Assembly A12 and Filter/Regulator A11, Schematic Diagram



ar Panel Assembly A12, Component Locations also mounted on the rear panel. This supply is comprised of a PC board, transformer, a capacitor mounted in the unit and a pass transistor located on the side casting. The supply is +5V @ 4 amps.

6-106. FILTER/REGULATOR ASSEMBLY A11. (Figure 6-49).

6-107. The filter regulator assembly consists of four PC boards: filter board A11A1, +5.2 V regulator A11A2, -12 V regulator A11A3, and motherboard A11A4. The motherboard (Figure 6-51) provides all the interconnection between the other three PC boards, rear panel assembly A12 and, logic and power distribution board A14.

*F1 and F2 should be 1.5 Amp Slo-Blo for 230 volt operation

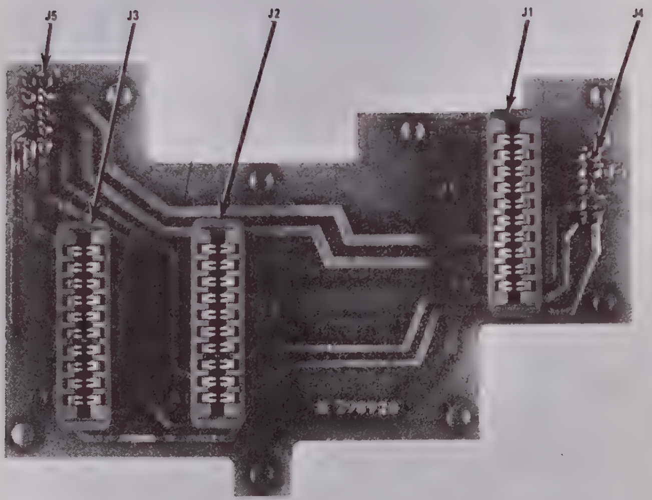


Figure 6-51. Power Supply Motherboard A11A4

6-108. FILTER BOARD A11A1. Filter board A11A1 (Figure 6-52) has seven individually removable inputs (E1 through E7) coming from bridge rectifiers BR1 and BR2 and transformer T1. Four of the inputs are connected across filter capacitors. The inputs at E1 and E6 are filtered by capacitors C1 through C4 in parallel and the filtered dc is applied through motherboard A11A4 to the collector of +5.2 V pass transistor A12Q1. The inputs at E7 and E5 are filtered by capacitors C5 through C8 in parallel and the filtered dc is applied through motherboard A11A4 to the collector of -12 V pass transistor A12Q2. Fuses F1 and F2 are provided to protect the supply from a catastrophic failure such as the pass transistor shorting where the regulators would not be able to control the current and very high dc currents would flow. Resistors R1 and R2 across the filter capacitors are bleeder resistors which allow the capacitors to discharge when the dc load current path is opened. The other three ac voltage inputs to the filter board are fed through the motherboard to the appropriate regulator board.

6-109. 5.2 V REGULATOR A11A2. The 5.2 V regulator (Figure 6-53) is basically an IC regulator driving a pass transistor (A12Q1) to boost current output capability. The regulators feature foldback current limiting and overvoltage protection. On the 5.2 V regulator, inputs AC1 and AC2 are rectified and filtered by CR1, CR2, and C6 providing the dc bias for U1. This input must be at least 3 volts greater than the output of pin 10. The output of U1 (pin 10), 5.2 PTB, drives the base of Darlington pass transistor A12Q1 while the emitter is returned to the regulator board where the dc load current passes through .05 ohm resistor R1 and is then brought out to the front panel assembly through connector J4 on the motherboard. Three other outputs from this board are 5.2 GND, 5.2 V SENSE, and GND SENSE which are also brought out to J4 on the motherboard.

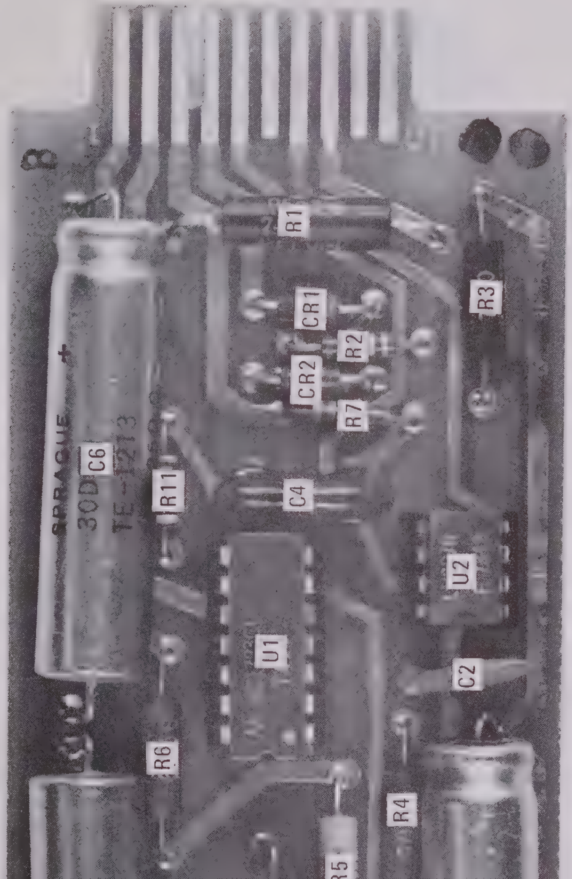
6-110. The 5.2V SENSE line is connected through R7 to pin 4 of U1 which is the inverting input to a differential amplifier inside U1. This is balanced against a reference input into pin 5 which is the noninverting input. The reference output of U1 (pin 6) is 7.15 volts which is divided down by R8, R9, and R10. R10 is the voltage adjust potentiometer which allows the reference input at pin 5 to be adjusted to +5.2 volts. Capacitor C5 is used to reduce the noise and ripple voltage on the regulated dc output. Capacitor C4 assures frequency stability of U1.

6-111. An important feature of this regulator is foldback current limiting which is provided by R1 through R6, C2, and U2. The voltage drop across R1 is amplified by U2 and applied through a voltage divider to pin 2 of U1. The voltage at pin 2 of U1 is now directly dependent on the voltage drop across R1 which depends on the load current. When the load current reaches 5.5 amp (0.5 amp above rated load), the voltage at pin 2 of U1 is approximately 0.7 volts greater than that at pin 3 of U1, which turns on an internal transistor. The transistor reduces the voltage and current drive capability of U1. As a result, the voltage and current outputs of the regulator start to drop. U2 requires two supplies, positive and negative. The positive supply comes from the voltage input to U1 through dropping resistor R11 to keep the supply voltage below the rated limit of U1. This voltage is also used to power U2 on the -12 V regulator and is therefore, an output from the 5.2 V regulator (foldback supply positive, FSP). The negative supply is generated on the -12 regulator board and is an input to this board (foldback supply minus, FSM).

6-112. -12 V REGULATOR A11A3. The -12 V regulator (Figure 6-54) is basically the same design as the 5.2 V regulator so only the differences will be described. Basically it is still a positive output regulator design where the positive end is grounded and the negative end is taken as the -12 volt output. Since the desired output of 12 volts is greater than the internal reference of 7.15 volts, the voltage divider adjust resistors (R7, R8, and R9) are wired to the inverting input of U1 (pin 4), where the adjustment is now made to place a voltage of +7.15 volts with respect to the -12 volt output (or -4.85 volts with respect to ground) on pin 4. Pin 4 is balanced against the internal reference of 7.15 volts which is connected to pin 5 from pin 6 of U1 through R10. An ac input (AC3) from the transistor is wired to R12, C5, C6, CR1 and CR2 to create the negative supply voltage for U2 on both regulator boards. All other component functions are identical to the 5.2 V regulator.

6-113. LOGIC AND POWER DISTRIBUTION A14. (Figures 6-55 and 6-56).

6-114. The voltage output and sense wires for the -12 V and +5.2 V regulators are connected at the input to line switch A1S1. The output of the switch is then wired to the logic and power distribution board A14 where they are distributed to the appropriate connectors which carry power to the different section of the system. In addition, the fan off signal comes from the line switch and is wired such that it is floating when the system is on and is wired to -12 V when the system is in standby. Another function of this board is to provide overvoltage protection for the system. The +5.2 volt overvoltage circuit consists of CR1 and SCR1. If the 5.2 V exceeds 7 volts, SCR1 fires shorting the 5.2 V to ground. Similarily CR2 and SCR2 protect the -12 V for voltages exceeding -15 volts. These circuits are used only in the power ON mode. In STBY



olt Regulator A11A2, Component Locations

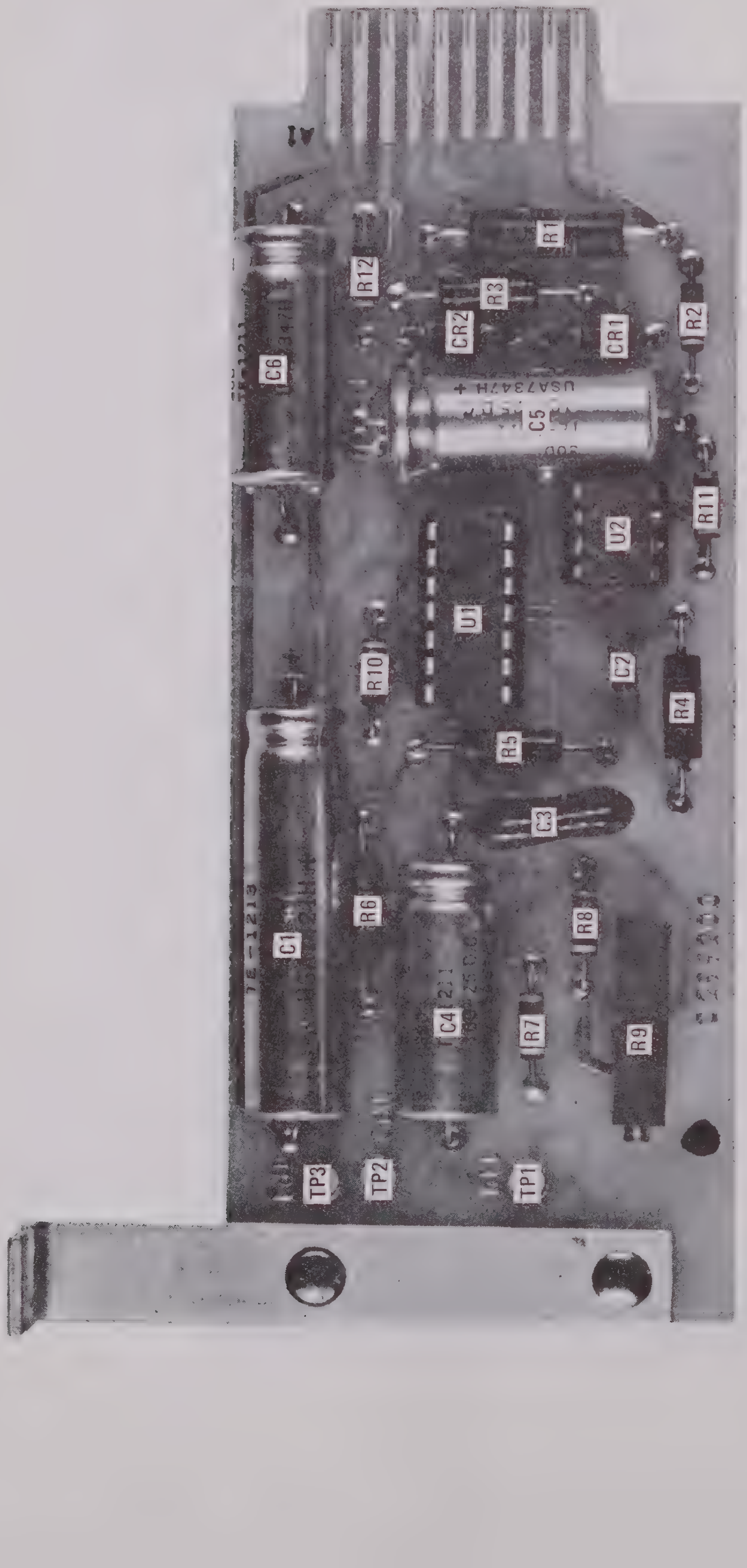
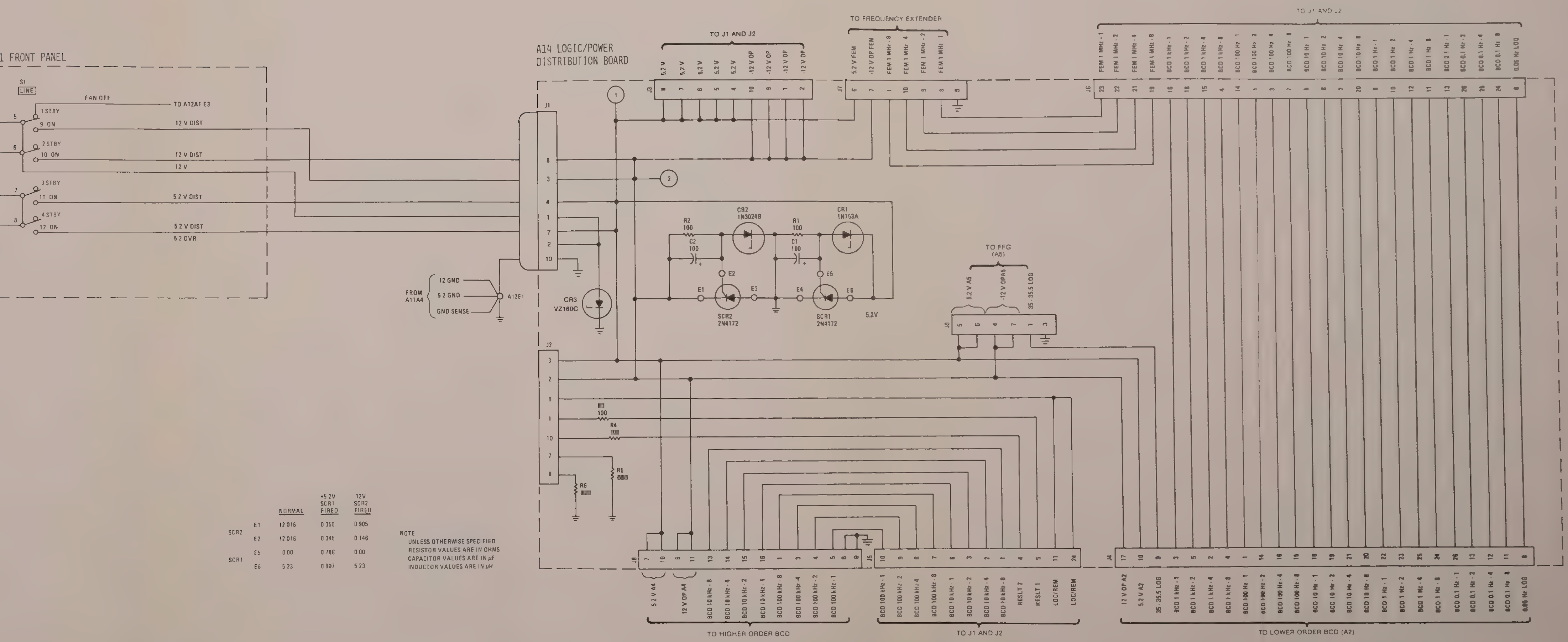


Figure 6-54. -12 Volt Regulator A11A3, Component Locations

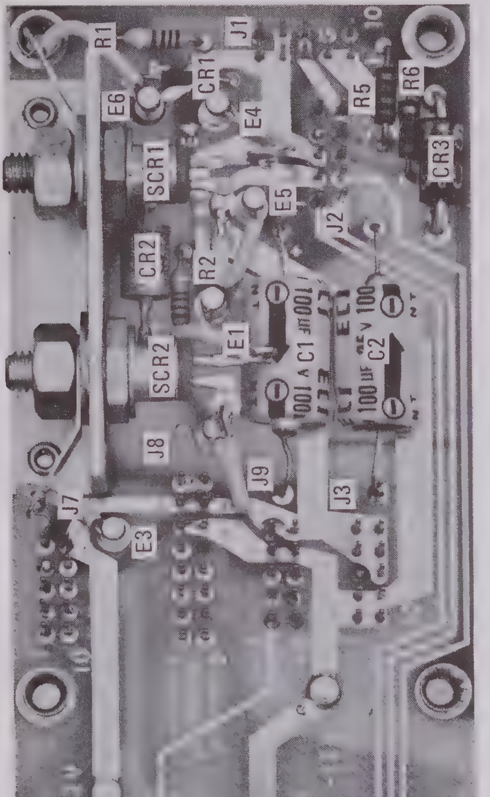


		NORMAL	+5 2V SCR1 FIRED	12V SCR2 FIRED
SCR2	E1	12 016	0 350	0 905
	E2	12 016	0 345	0 146
SCR1	E5	0 00	0 786	0 00
	E6	5 23	0 907	5 23

NOTE
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-55. Logic and Power Distribution Board A14, Schematic Diagram

-788



ower Distribution Board A14, Component Locations it is necessary to protect the -12 volts. This is accomplished by diode CR3. If an SCR does fire due to an overvoltage condition, ac power must be removed from the unit. If the overvoltage condition has been eliminated, power may be reapplied to restore dc power. The ground return wires for +5.2 and -12 volts and the ground sense wire are each brought out and wired to the single point chassis ground.

6-115. MPU ASSEMBLY A15. (Figure 6-57).

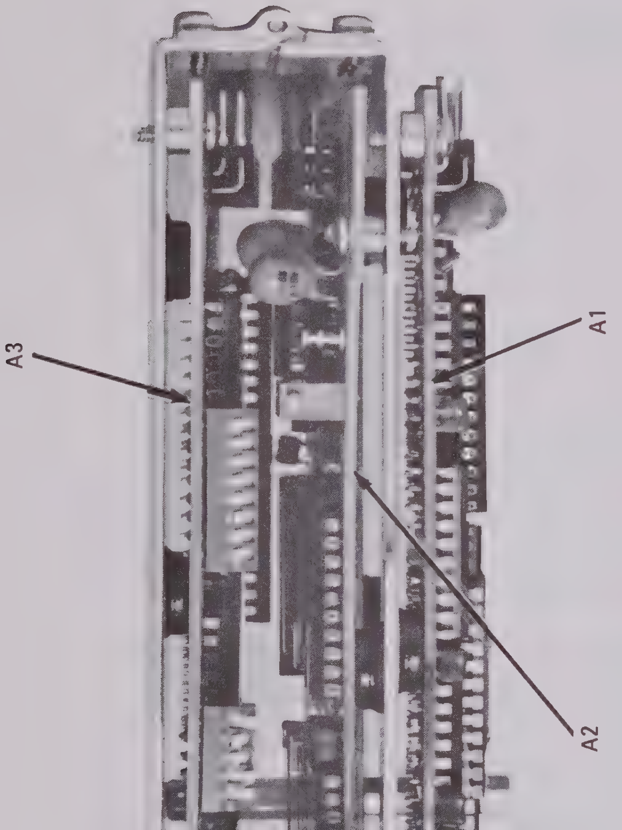
6-116. The MPU assembly contains the MPU PC board assembly A15A1, Latch PC board assembly A15A2 and GPIB PC board assembly A15A3.

6-117. MPU BOARD ASSEMBLY A15A1. (Figures 6-58 through 6-60). The MPU board assembly contains the following major component blocks:

a. MPU (Microprocessor Unit)
b. DMA (Direct Memory Access)
c. Timing Generator
d. Address Decoders
e. RAM (Random Access Memory)
f. ROM (Read Only Memory)
g. PIC (Priority Interrupt Controller)
h. Data Latches for ATT and MPB Bits
i. The Power-Down Interrupt Generator

6-118. MICROPROCESSOR UNIT U20. Microprocessor Unit U20 performs the central control function of the 380 Synthesized Signal Generator. The MPU has the following features.

- Eight-bit parallel processing
- Bi-directional data bus
- Sixteen-bit address bus
- 72 instructions
- Seven addressing modes - Direct - Relative - Immediate, - Indexed, - Extended, - Implied, - Accumulator
- Variable length stack
- Vectored restart
- Maskable interrupt vector
- Separate non-maskable interrupt
- Six internal registers - two accumulators - Index register - Program counter, - Stock pointer, - Condition code register
- Direct memory addressing (DMA) capability



igure 6-57. MPU Assembly A15

6-119. MPU SIGNAL DESCRIPTION. (Table 6-3). Proper operation of the MPU requires that certain control and timing signals be provided to accomplish specific functions and that other signal lines be monitored to determine the state of the processor.

6-120. DIRECT MEMORY ACCESS (DMA) U17. The Direct Memory Access Controller (DMAC) performs the function of transferring data directly between memory and peripheral device controllers, in this case the GPIA. It controls the address and data buses in place of the MPU in bus organized systems.

6-121. The bus interface of U17 includes select, read/write, interrupt, transfer request/grant, and bus interface logic to allow the data transfer over an 8-bit bidirectional data bus. The functional configuration of the DMAC is programmed via the data bus. The internal structure provides for control and handling of four individual channels, each of which is separately configured. Programmable control registers provide control for the transfer location and length, individual channel control and transfer mode configuration, priority of servicing, data chaining, and interrupt control. Status and control lines provide control to the peripheral controllers. The mode of transfer for each channel can be programmed as cycle-stealing or a burst transfer mode. The 380 utilizes only the cycle-stealing mode.

6-122. DEVICE OPERATION. The DMAC has fifteen addressable registers, eight of these are sixteen bits in length. Each channel has a separate address register and a byte count register, each of which is sixteen bits. There are also four channel control registers. The three general control registers common to all four channels are the priority control register, the interrupt control register, and the data chain register.

6-123. To prepare a channel for DMA, the address registers must be loaded with the starting memory address and the byte count register loaded with the number of bytes to be transferred. The bits in the channel control register establish the direction of the transfer, the mode, and the address increment or decrement after each cycle. Each channel can be set for one of three transfer modes: Three-state control (TSC) steal, halt steal, or halt burst. Two read-only status bits in the channel control register indicate when the channel is busy transferring data and when the DMA transfer is completed.

6-124. The priority control register enables the transfer requests from the peripheral controllers and establishes either a fixed priority or rotating priority scheme of servicing these requests.

6-125. When the DMA transfer for a channel is complete (the byte count register is zero), a DMA end signal is directed to the peripheral controller and an $\overline{\text{IRQ}}$ goes to the MPU. Enabling of these interrupts is done in the interrupt control register. The DMA end/$\overline{\text{IRQ}}$ flag bit is read from this register.

6-126. Chaining of data transfer is controlled by the data chain register. When enabled, the contents of the address and byte count registers for channel #3 are put into the registers of the channel selected for chaining when its byte count register becomes zero. This allows for repetitively reading or writing a block of memory.

6-127. During the DMA mode, the DMAC controls the address bus and data bus for the system as well as providing the R/$\overline{\text{W}}$ line and a signal to be used as VMA. When a peripheral device controller desires a DMA transfer, it is requested by a transfer request. Assuming this request is enabled and meets the test

TABLE 6-3. MPU SIGNAL DESCRIPTIONS

Signal Name	Description
CLOCKS PHASE ONE AND PHASE TWO (01, 01)	Two pins are used for a two-phase non-overlapping clock that runs at the VCC voltage level.
ADDRESS BUS (A0-A15)	Sixteen pins are used for the address bus. The outputs are three-state bus drivers capable of driving one standard TTL load and 90 pF. When the output is turned off, it is essentially an open circuit. This permits the MPU to be used in DMA applications. Putting TSC in its high state forces the address bus to go into the three-state mode.
DATA BUS (D0-D7)	Eight pins are used for the data bus. It is bi-directional, transferring data to and from the memory and peripheral devices. It also has three-state output buffers capable of driving one standard TTL load and 130 pF. Data bus is placed in the three-state mode when DBE is low.
DATA BUS ENABLE (DBE)	This input is the three-state control signal for the MPU data bus and will enable the bus drivers when in the high state. This input is TTL compatible; however, in normal operation, it would be driven by the phase two clock. During an MPU read cycle, the data bus drivers will be disabled internally.

TABLE 6-3. MPU SIGNAL DESCRIPTIONS (Cont)

Signal Name	Description
BUS AVAILABLE (BA) (Cont)	will go to their off state and other outputs to their normally inactive level. The processor is removed from the WAIT state by the occurence of a maskable (mask bit 1 = 0) or nonmaskable interrupt. This output is capable of driving one standard TTL load and 30 pF. If TSC is in the high state, bus available will be low.
READ/$\overline{\text{WRITE}}$ (R/$\overline{\text{W}}$)	This TTL compatible output signals the peripherals and memory devices whether the MPU is in a Read (high) or Write (low) state. The normal standby state of this signal is Read (high). Three-State Control going high will turn Read/$\overline{\text{Write}}$ to the off (high impedance) state. Also, when the processor is halted, it will be in the off state. This output is capable of driving one standard TTL load and 90 pF.
RESET	The reset input is used to reset and start the MPU from a power down condition resulting from a power failure or initial start-up of the processor. This input can also be used to reinitialize the machine at any time after startup. If a high level is detected in this input, this will signal the MPU to begin the reset sequence. During the reset sequence, the contents of the last two locations (FFFE, FFFF) in memory will be loaded into the program counter to point to the beginning of the reset routine. During the reset routine, the interrupt mask bit is set and must be cleared under program control before the MPU can be interrupted by IRQ. While reset is low (assuming a minimum of 8 clock cycles have occurred) the MPU output signals will be in the following states: VMA = low, BA = low, Data Bus = high impedance, R/$\overline{\text{W}}$ = high (read state), and the address bus will contain the reset address FFFE. After the power supply reaches 4.75 volts a minimum of eight clock cycles are required for the processor to stabilize in preparation for restarting. During these eight cycles, VMA will be in an indeterminate state so any devices that are enabled by VMA which could accept a false write during this time must be

TABLE 6-3. MPU SIGNAL DESCRIPTIONS (Cont)

Signal Name	Description
RESET (Cont)	disabled until VMA is forced low after eight cycles. $\overline{\text{Reset}}$ can go high asynchronously with the system clock any time after the eighth cycle.
$\overline{\text{INTERRUPT REQUEST}}$ ($\overline{\text{IRQ}}$)	This level sensitive input requests that an interrupt sequence be generated within the machine. The processor will wait until it completes the current instruction that is being executed before it recognizes the request. At that time, if the interrupt mask bit in the Condition Code Register is not set, the machine will begin an interrupt sequence. The Index Register, Program Counter, Accumulators, and Condition Code Register are stored away on the stack. Next the MPU will respond to the interrupt request by setting the interrupt mask bit high so that no further interrupts may occur. At the end of the cycle, a 16-bit address will be loaded that points to a vectoring address which is located in memory locations FFF8 and FFF9. An address loaded at these locations causes the MPU to branch to an interrupt routine in memory. The $\overline{\text{Halt}}$ line must be in the high state for interrupts to be serviced. Interrupts will be latched internally while $\overline{\text{Halt}}$ is low.

TABLE 6-3. MPU SIGNAL DESCRIPTIONS (Cont)

Signal Name	Description
NON-MASKABLE INTERRUPT (NMI) and WAIT FOR INTERRUPT (WAI) (Cont)	at time t_{PCS} in cycle #1 which precedes the first cycle of an instruction (OP code fetch). This instruction is not executed but instead the Program Counter (PC), Index Register (IX), Accumulators (ACCX), and the Condition Code Register (CCR) are pushed onto the stack. The Interrupt Mask bit is set to prevent further interrupts. The address of the interrupt service routine is then fetched from FFFC, FFFD for an $\overline{\text{NMI}}$ interrupt and from FFF8, FFF9 for an $\overline{\text{IRQ}}$ interrupt. Upon completion of the interrupt service routine, the execution of RTI will pull the PC, IX, ACCX, and CCR off of the stack; the Interrupt Mask bit is restored to its condition prior to Interrupts.
THREE STATE CONTROL (TSC)	When the three-state control (TSC) line is a logic 1, the address bus and the R/$\overline{\text{W}}$ line are placed in a high impedance state. VMA and BA are forced low when TSC = 1 to prevent false reads or writes on any device enabled by VMA. It is necessary to delay program execution while TSC is held high. This is done by insuring that no transitions of 01 (or 02) occur during this period. (Logic levels of the clocks are irrelevant so long as they do not change). Since the MPU is a dynamic device, the 01 clock can be stopped for a maximum time PW_{0H} without destroying data within the MPU. TSC then can be used in a short Direct Memory Access (DMA) application.
VALID MEMORY ADDRESS (VMA)	This output indicates to peripheral devices that there is a valid address on the address bus. In normal operation, this signal should be utilized for enabling peripheral interfaces such as the PIA and ACIA. This signal is not three-state. One standard TTL load and 90 pF may be directly driven by this active high signal.
$\overline{\text{HALT}}$	When this input is in the low state, all activity in the machine will be halted. This input is level sensitive.

TABLE 6-3. MPU SIGNAL DESCRIPTIONS (Cont)

Signal Name	Description
$\overline{\text{HALT}}$ (Cont)	The $\overline{\text{Halt}}$ line provides an input to the MPU to allow control of program execution by an outside source. If $\overline{\text{Halt}}$ is high, the MPU will execute the instructions; if it is low, the MPU will go to a halted or idle mode. A response signal, Bus Available (BA) provides an indication of the current MPU status. When BA is low, the MPU is in the process of executing the control program; if BA is high, the MPU has halted and all internal activity has stopped. When BA is high, the Address Bus, Data Bus, and R/$\overline{\text{W}}$ line will be in a high impedance state, effectively removing the MPU from the system bus. VMA is forced low so that the floating system bus will not activate any device on the bus that is enabled by FMA.

of highest priority, the DMAC will issue a DMA request. When the DMAC receives the DMA grant, it gives a transfer acknowledge to the peripheral device controller, at which time the data is transferred. When the channels byte count register equals zero, the transfer is complete and a DMA end is given to the peripheral device controller, and an $\overline{\text{IRQ}}$ is given to the MPU.

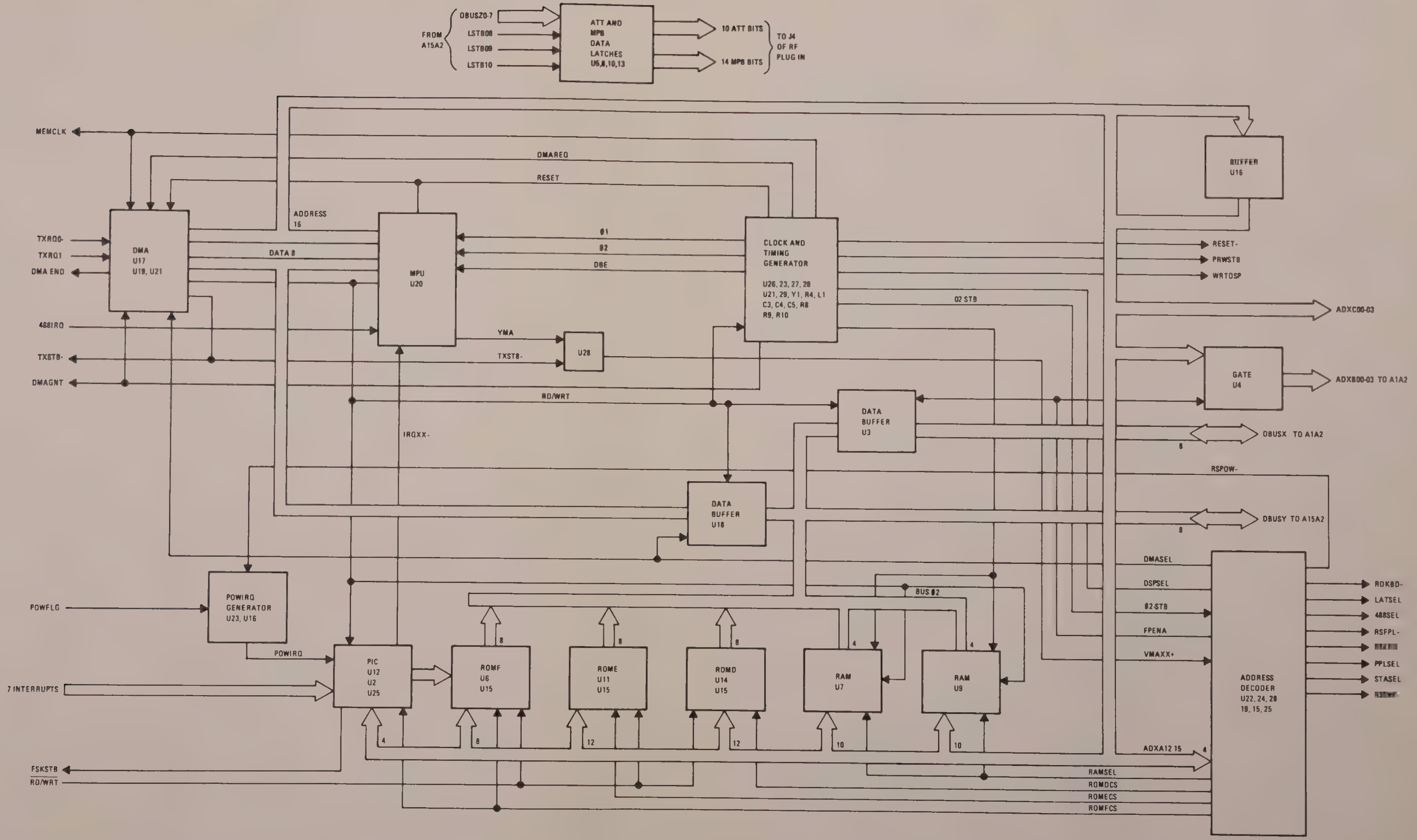
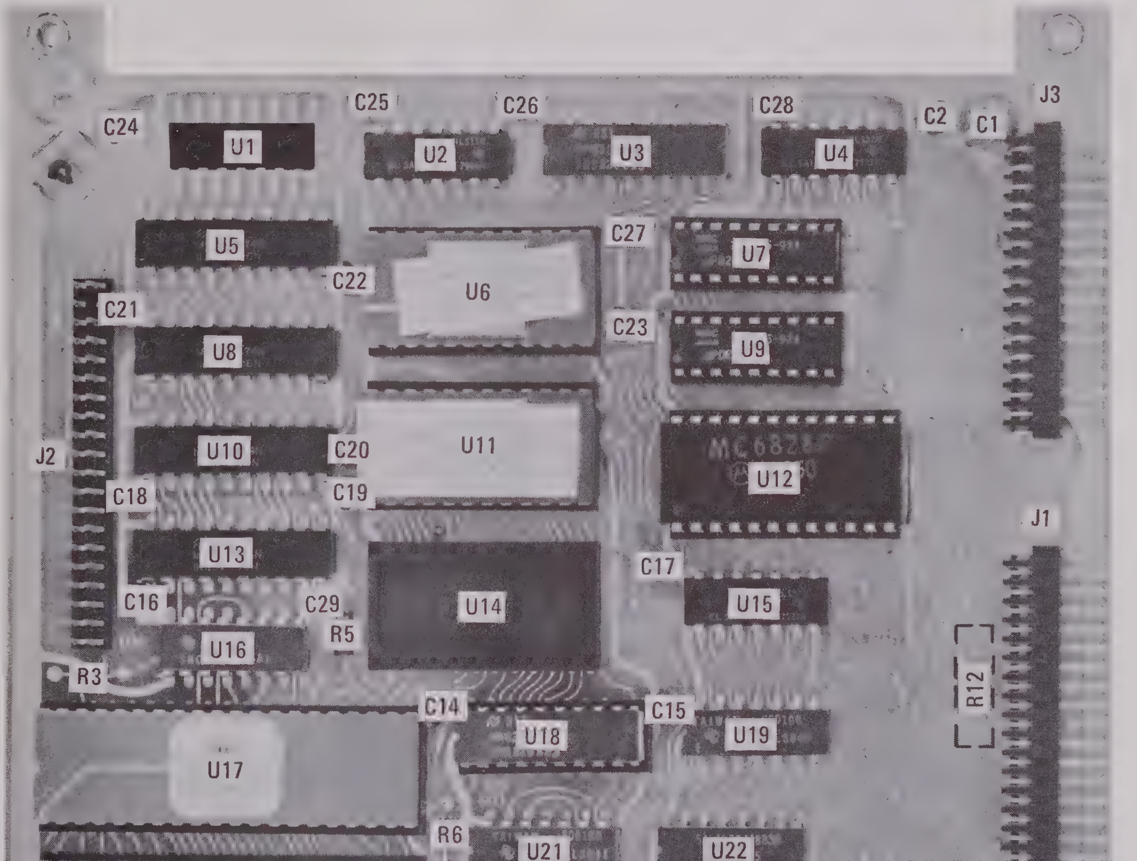


Figure 6-58. MPU PC Board, Block Diagram


C24
U1
C25
U2
C26
U3
C28
U4
C2
C1
J3
U5
C22
U6
C27
U7
C21
U8
C23
U9
J2
U10
C20
U11
U12
MC6828
C18
C19
U13
J1
C17
U15
C16
C29
U14
R5
U16
R3
R12
C14
U18
C15
U19
U17
R6
U21
U22

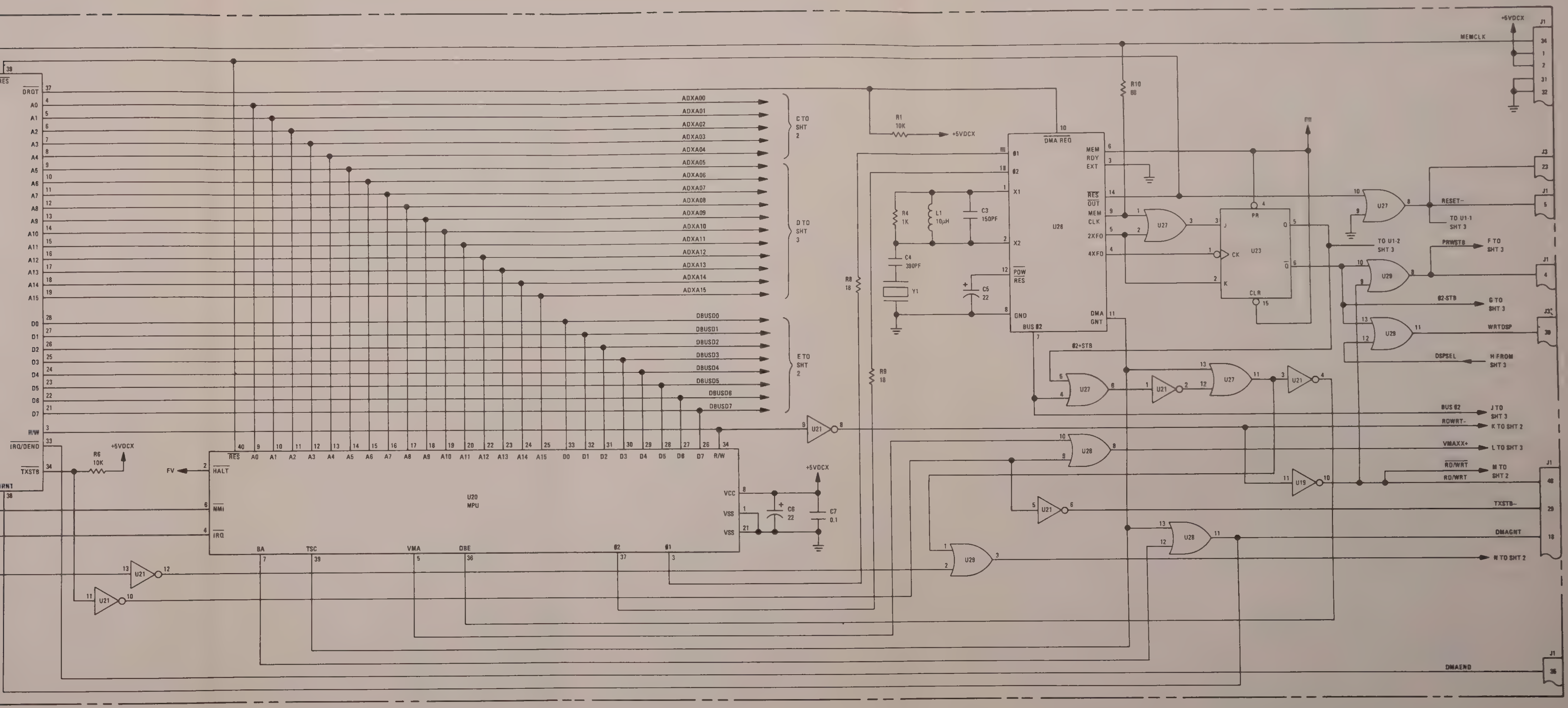


Figure 6-60. MPU PC Board A15A1, Schematic Diagram (Sheet 1 of 4)

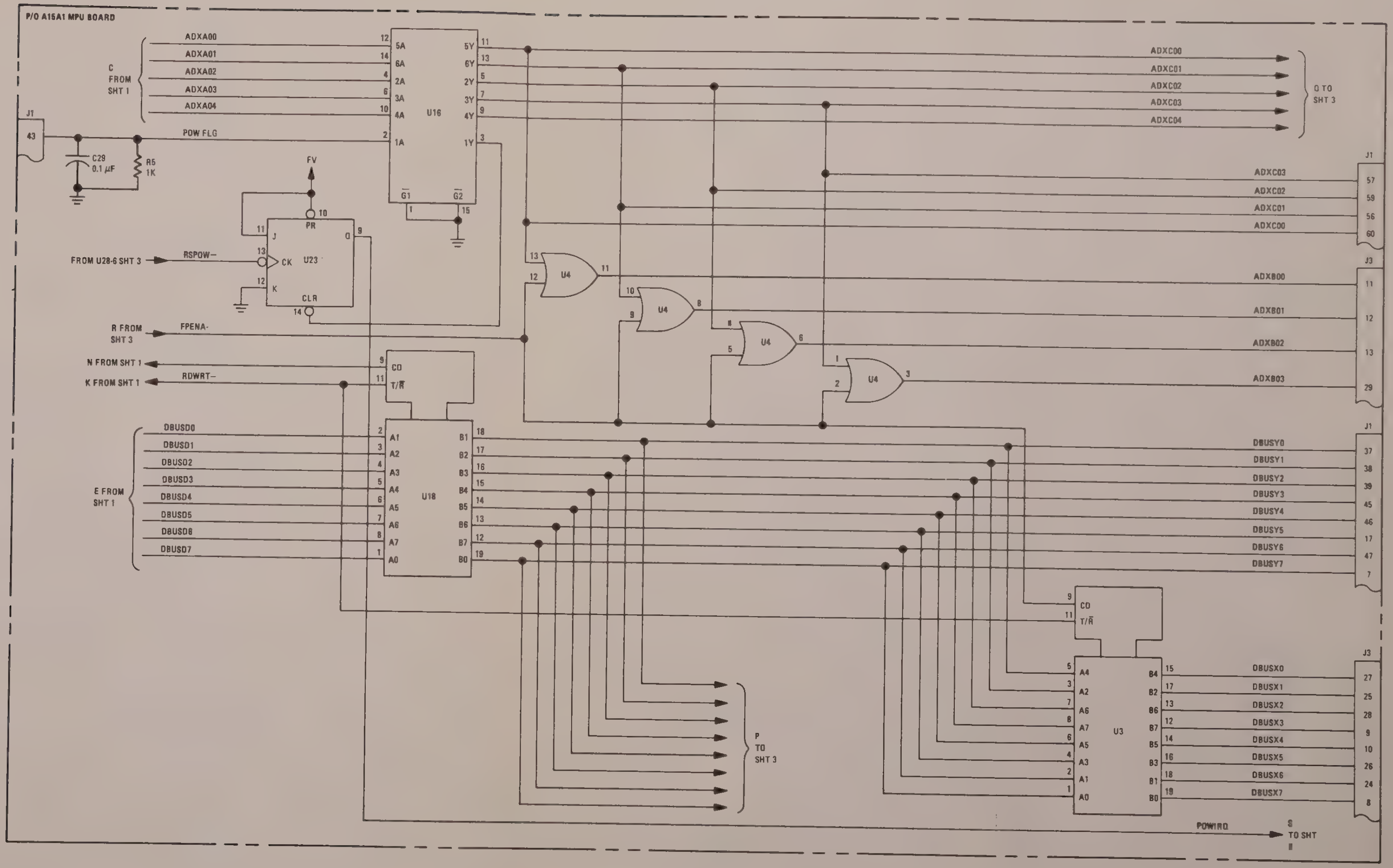


Figure 6-60. MPU PC Board A15A1, Schematic Diagram (Sheet 2 of 4)

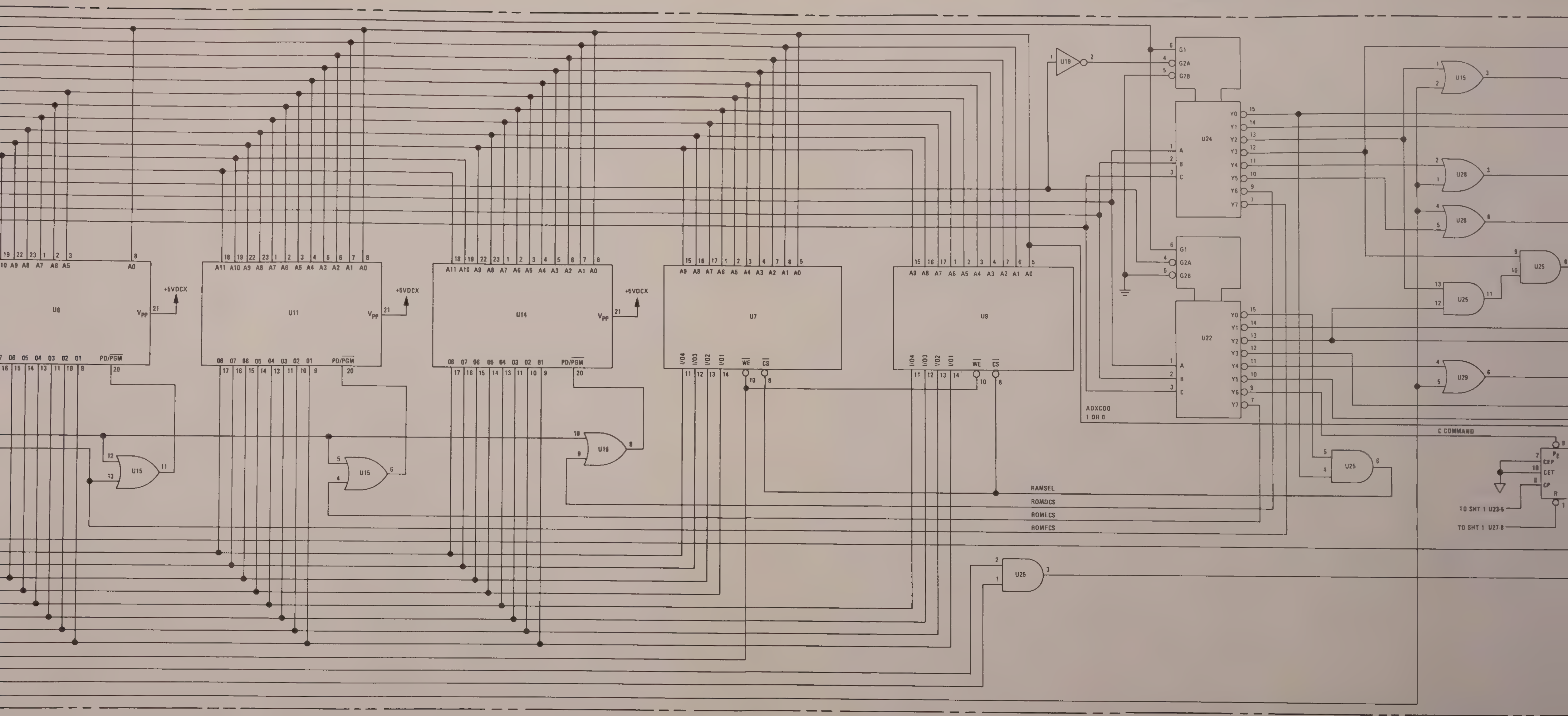
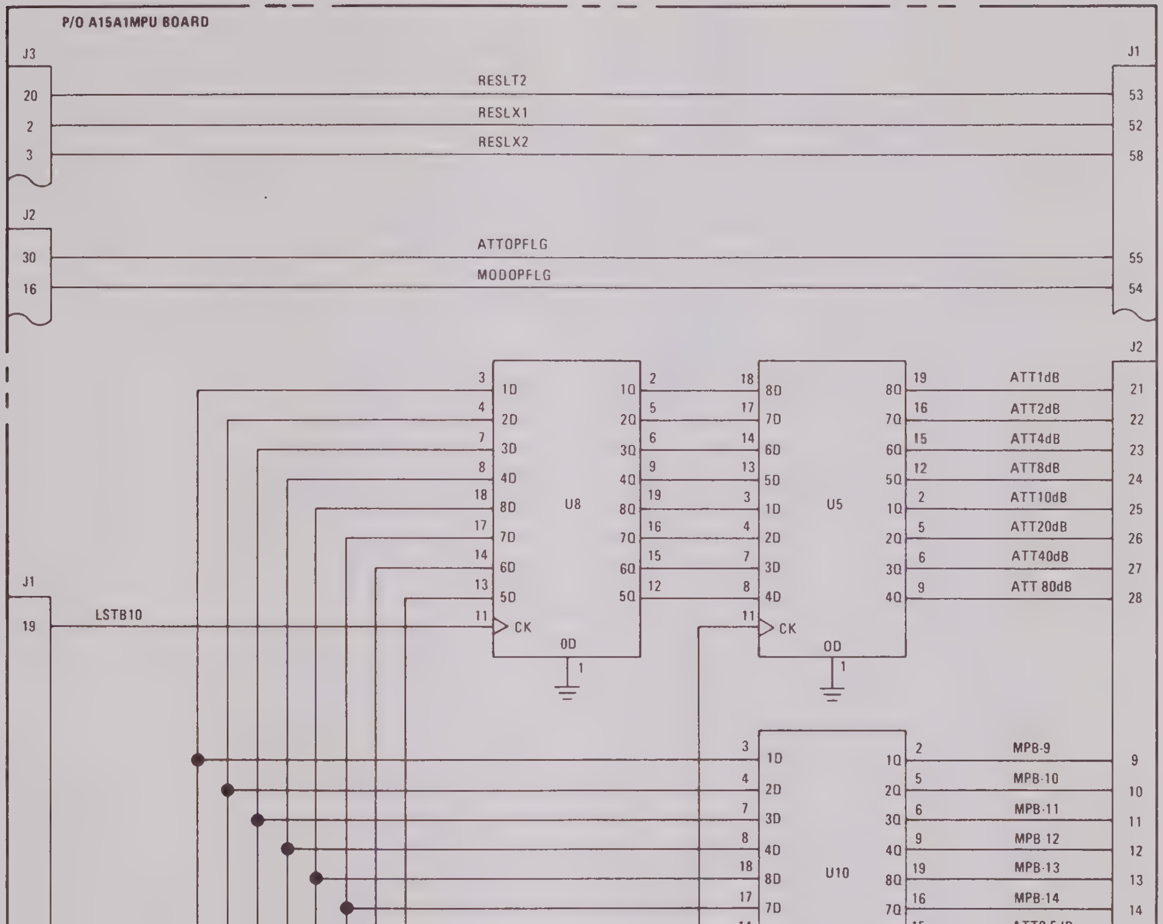
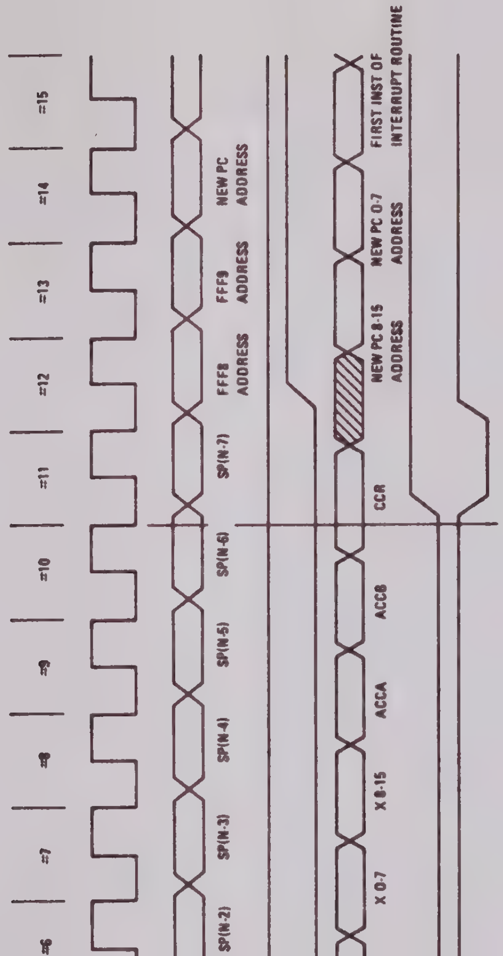


Figure 6-60. MPU PC Board A15A1 Schematic Diagram (Sh


P/O A15A1MPU BOARD
J3
J1
RESLT2
RESLX1
RESLX2
J2
ATTOPFLG
MODOPFLG
J2
J1
LSTB10
U8
U5
U10
CK
OD
ATT1dB
ATT2dB
ATT4dB
ATT8dB
ATT10dB
ATT20dB
ATT40dB
ATT 80dB
MPB-9
MPB-10
MPB-11
MPB 12
MPB-13
MPB-14



ure 6-61. Interrupt, Timing Diagram

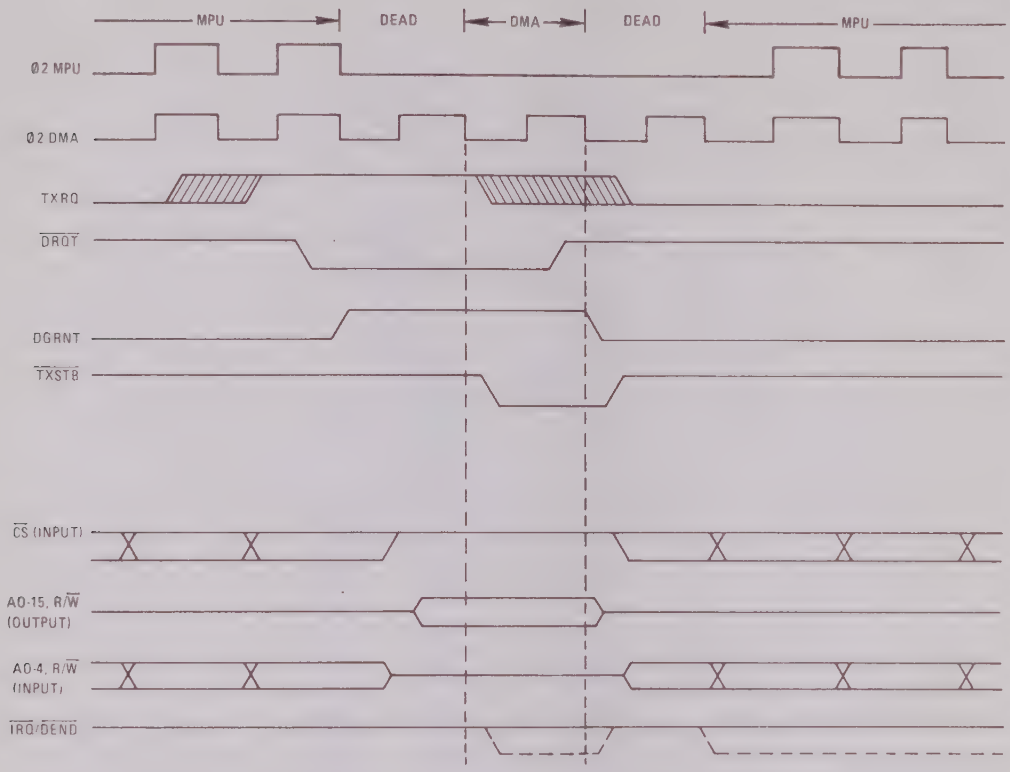

MPU
DEAD
DMA
DEAD
MPU
Ø2 MPU
Ø2 DMA
TXRQ
$\overline{\text{DRQT}}$
DGRNT
$\overline{\text{TXSTB}}$
$\overline{\text{CS}}$ (INPUT)
A0-15, R/$\overline{\text{W}}$ (OUTPUT)
A0-4, R/$\overline{\text{W}}$ (INPUT)
$\overline{\text{IRQ}}$/$\overline{\text{DEND}}$

Figure 6-62. TSC Steal Mode, Timing Diagram

6-131. Input/Output Functions. (Table 6-4). The DMAC interfaces with the MPU through the eight-bit bidirectional data bus, the chip select line, five address lines, an interrupt request line, the read/write line, and the reset line. These signals, in conjunction with the VMA output, permit the MPU to have access to the DMAC. Four other lines associated with the MPU and the clock driver are the $\overline{\text{DRQT}}$, $\overline{\text{DRQH}}$, DGRNT, and the 02 DMA.

6-132. DMAC Registers. (Table 6-5). All of the fifteen registers in the DMAC are Read/$\overline{\text{Write}}$ registers, although some of the bits are read only status bits.

6-133. Timing Generator. The timing generator supplies the non-overlapping two phase clock signals required by the microprocessor. It also generates the power-on system reset signal and other signals used to synchronize the entire system. The major components of the timing generator are U26 and U23. (Table 6-6).

6-134. Oscillator. (Y1, C4, R4, L1, C3) A tank circuit tuned to 4 MHz connected between terminals X1 and X2 is used to prevent the oscillator from starting at other than the desired frequency. The 1000 ohm capacitor resistor (R4) reduces the Q sufficiently to maintain stable crystal control. C4 is used in series with the crystal for optimum performance at series resonance.

TABLE 6-4. INPUT/OUTPUT FUNCTIONS

Signal Name	Description
DMAC INTERFACE SIGNALS FOR THE MPU	
BIDIRECTIONAL DATA (D0-D7)	The bidirectional data lines (D0-D7) allow for data transfer between the DMAC and the MPU. The data bus output drivers are three-state devices that remain in the high impedance state except when the MPU performs DMAC read operations.
$\overline{\text{CHIP SELECT}}$/TRANSFER ACKNOWLEDGE B ($\overline{\text{CS}}$/TxAKB)	This line is multiplexed, serving both as an input and an output. $\overline{\text{CS}}$/TxAKB is an output in the four-channel mode during the DMA transfer. At all other times, it is a high impedance TTL compatible input used to address the DMAC. The DMAC is selected when $\overline{\text{CS}}$/TxAKC is LOW. VMA must be used in generating this input to insure that false selects will not occur. Transfers of data to and from the DMAC are then performed under the control of the 02 DMA, Read/$\overline{\text{Write}}$, and A0-A4 address lines. In the four-channel mode when TxAKB is needed, the $\overline{\text{CS}}$ gate must have an open-collector output (a pull-up resistor should not be used). In the two channel mode, $\overline{\text{CS}}$/TxAKB is always an input.

TABLE 6-4. INPUT/OUTPUT FUNCTIONS (Cont)

Signal Name	Description
READ/$\overline{\text{WRITE}}$ (R/$\overline{\text{W}}$)	Read/$\overline{\text{Write}}$ is a TTL compatible line that is a high impedance input in the MPU mode and an output in the DMA mode. In the MPU mode, it is used to control the direction of data flow through the DMACs input/output data bus interface. When Read/$\overline{\text{Write}}$ is HIGH (MPU read cycle) and the chip is selected, DMAC data output buffers are turned on and a selected register is read. When it is LOW, the DMAC output drivers are turned off and the MPU writes into a selected register. In the DMA mode, Read/$\overline{\text{Write}}$ is an output to drive the memory and peripheral controllers. Its stats is determined by bit 0 of the channel control register for the channel being serviced. When Read/$\overline{\text{Write}}$ is HIGH, the memory is read and the data from the memory is written into the peripheral controller. When it is LOW, the peripheral controller is read and its data stored in the memory. In the DMA mode, the DMAC data buffers are off, so data is not available on the Data Bus (D0-D7).
$\overline{\text{RESET}}$ ($\overline{\text{RES}}$)	The $\overline{\text{RES}}$ input provides a means of resetting the DMAC from an external source. In the LOW state, the $\overline{\text{RES}}$ input causes all registers, with the exception of the address and byte count registers, masks all interrupts, disables the data chain function, and puts each channel control register into the condition of memory write, halt steal transfer mode, and address increment.
TRANSFER SIGNALS TO THE MPU	
	Two DMA request output lines and a DMA Grant input line, together with the system clock, synchronize the DMAC with the MPU system.
$\overline{\text{DMA REQUEST THREE-STATE}}$ $\overline{\text{CONTROL STEAL}}$ ($\overline{\text{DRQT}}$)	This active LOW output requests a DMA transfer for a channel configured for the TSC steal transfer mode. This line is connected to the system clock driver, requesting a 01 clock stretch.

L-788

TABLE 6-4. INPUT/OUTPUT FUNCTIONS (Cont)

Signal Name	Description
DMA REQUEST HALT STEAL ($\overline{\text{DRQH}}$)	This active LOW output requests a DMA transfer for a channel programmed for the halt steal or halt burst mode transfer. This line is connected directly to the MPU $\overline{\text{HALT}}$ input and remains low until the last byte has begun to be transferred. This output is not used on the 380 Synthesized Signal Generator.
DMA GRANT (DGRNT)	This is a high impedance input to the DMAC, giving it control of the system busses. For the TSC Steal mode, the signal comes from the system clock drive circuit (DMA Grant), indicating that the clock is being stretched. For either of the halt modes, this signal is the bus available from the MPU, indicating that the MPU has halted and turned control of its busses over to the DMAC. For a design involving TSC steal and halt mode transfers, this input must be the OR of the clock driven DMA grant and the MPU BA.

TABLE 6-5. DMAC REGISTERS

TABLE 6-5. DMAC REGISTERS (Cont)

Signal Name	Description
CHANNEL CONTROL REGISTERS	
	The control of each channel's DMA transfer is programmed into its channel control register. Bits 4 and 5 are unused.
READ/$\overline{\text{WRITE}}$ (R/$\overline{\text{W}}$), Bit 0	The direction of the DMA transfer is controlled by this bit. When it is HIGH, the peripheral controller reads the memory. When it is LOW, the transfer will be in the opposite direction, thus writing into the memory. The system R/$\overline{\text{W}}$ line is in the same state as this R/$\overline{\text{W}}$ bit in the DMA mode. The device controller must change the sense of its R/$\overline{\text{W}}$ input during the DMA mode.
BURST/STEAL, Bit 1	This bit, along with bit 2, selects the mode of the DMA transfer. With bit 1 HIGH, the burst mode is selected. A LOW selects the steal mode.
TSC/HALT, Bit 2	Bit 2 helps select the mode of DMA transfer. When this bit is HIGH, the TSC mode is selected. When LOW, the halt mode is selected.
ADDRESS UP/DOWN, Bit 3	Bit 3 controls the change in the address register for each DMA cycle. If this bit is LOW, the address register will be incremented each time the byte count register decrements. If the bit is HIGH, the address register will decremented.
BUSY/READY FLAG, Bit 6	The Busy/Ready Flag is a read only status bit that indicates a DMA transfer is in process on that channel. This bit goes HIGH at the beginning of the transfer and remains so until the $\overline{\text{IRQ}}$/$\overline{\text{DEND}}$ has been LOW for one cycle (DMA End). The bit is then reset and the channel can again be configured for a transfer.
DMA END FLAG (DEND), Bit 7	The DEND bit indicates a DMA block transfer has ended. This bit is set at the same time the Busy/Ready Flag is reset. The DEND bit is reset by the MPU reading the channel control register. This bit causes an interrupt if enabled in the interrupt control register.

L-788

TABLE 6-5. DMAC REGISTERS (Cont)

Signal Name	Description
PRIORITY CONTROL REGISTER	
	The enabling and prioritizing of the transfer request (TxRQs) are done in the priority control register. Bits 4 through 6 are unused.
REQUEST ENABLE (RE0-3), BIT 0-3	The four channels are individually enabled by setting the respective RE bit HIGH. A LOW on any of these bits disables recognition of the transfer request for that channel. The bit number equals the channel number (i.e., bit 2 equals channel #2).
ROTATE CONTROL, Bit 7	The DMAC priority service routine is selected by this rotate control bit. When it is LOW, the fixed mode is selected. Channel #0 has the highest priority, channel #1 the next highest, and so on down. When this bit is HIGH, a rotating routine is used. This routine states that initially it will be the same as in the fixed mode. But once a channel has been serviced, it moves to the lowest priority and those that were below it advance to the next highest priority.
INTERRUPT CONTROL REGISTER	

TABLE 6-5. DMAC REGISTERS (Cont)

Signal Name	Description
DATA CHAIN REGISTER	
	Repetitive reading or writing of a block of memory can be done in the data chain function. A DMA transfer cannot be active on channel #3 during the data chain. Bits 4 through 7 are unused.
DATA CHAIN ENABLE (DCE), Bit 0	The data chain function is enabled when this bit is HIGH.
DATA CHAIN CHANNEL SELECTS A, B (DCA, DCB), Bits 1 and 2	The channel updated by data chaining is selected by bits 1 and 2. The data chain function is performed by transferring the contents of channel #3 address and byte count registers into the respective registers of the channel selected by bits 1 and 2. This transfer is done during the cycle of 02 DMA following the byte count register having decremented to zero.
TWO/FOUR CHANNEL SELECT (2/4), Bit 3	The DMAC is configured to handle two or four channels by bit 3. This bit HIGH selects the 4-channel mode. In this mode, the $\overline{\text{CS}}$/TxAKB becomes a chip select in the MPU mode and a transfer acknowledge B for the DMA mode. With bit 3 LOW, the 2-channel mode is selected, and the $\overline{\text{CS}}$/TxAKB line is always a chip select, both for the MPU and the DMA mode.
02 DMA	Transferring in and out of the DMAC registers, sampling of channel request lines and gating of other control signals to the system is done internally in conjunction with the 02 DMA high impedance input. This input must be the system memory clock (non-stretched 02 clock).
TRANSFER SIGNALS FROM THE PERIPHERAL CONTROLLER	
TRANSFER REQUEST (TxRQ0-3)	Each of the four channels has its own high impedance input request for transfer line. The peripheral controller requests a transfer by setting its TxRQ line HIGH (a logic 1). The lines

L-788

TABLE 6-5. DMAC REGISTERS (Cont)

Signal Name	Description
TRANSFER REQUEST (TxRQ0-3) (Cont)	are sampled according to the priority and enabling established in the priority control register. In the steal mode and the first byte of the halt burst mode, the TxRQ signals are tested on the positive edge of 02 DMA and the highest priority channel is strobed. Once strobed, the TxRQs are not tested until that channel's data transfer is finished. In the succeeding bytes of the halt burst mode transfer, the TxRQ is tested on the negative edge of 02 DMA, and data is transferred on the next 02 DMA cycle if TxRQ is HIGH.
$\overline{\text{TRANSFER STROBE}}$ ($\overline{\text{TxSTB}}$)	The $\overline{\text{Transfer Strobe}}$ causes acknowledgement to be given to the peripheral controller and transfers the data to or from the memory. This line is also intended to be the VMA signal for the system in the DMA mode.
$\overline{\text{INTERRUPT REQUEST}}$/$\overline{\text{DMA END}}$ ($\overline{\text{IRQ/DEND}}$)	In the DMA mode, this dual purpose line is LOW for the last byte of transfer, indicating a DMA end. This occurs when the byte counter register decrements to zero. This line, through the decode of TxAKA and $\overline{\text{CS}}$/TxAKB, can be used to strobe a DMA end to each device controller.

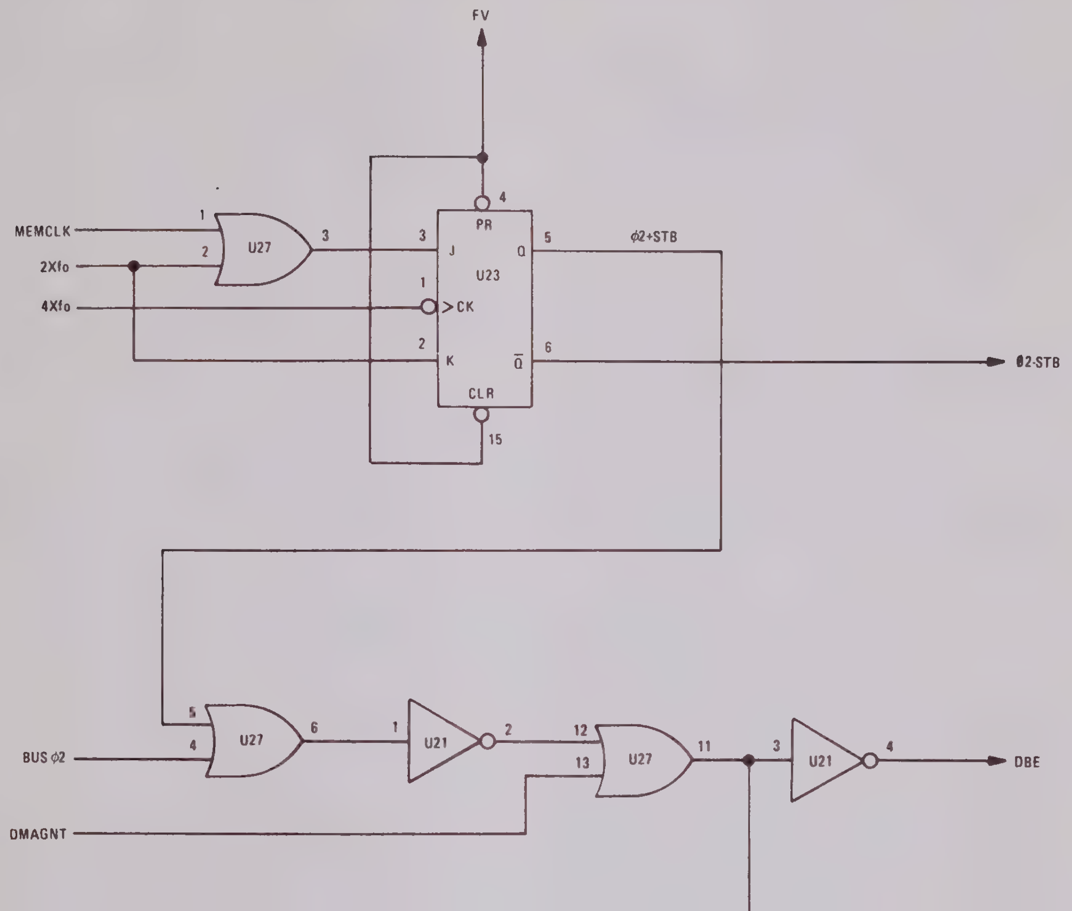
TABLE 6-6. TIMING GENERATOR U26 PIN FUNCTIONS

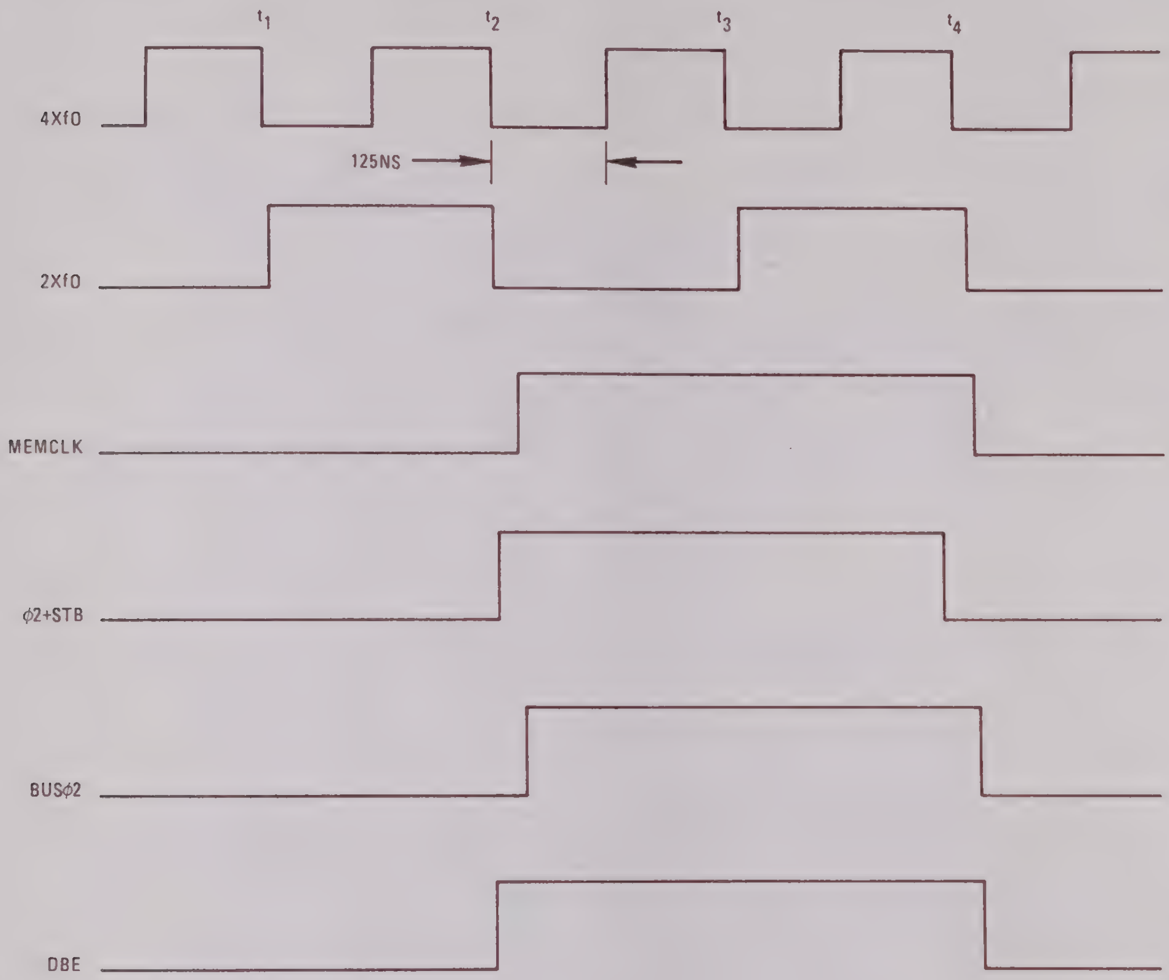
Pin Functions	Description
4xfo	A free running oscillator at four times the MPU clock rate of 1 MHz.
2xfo	A free running oscillator at two times the MPU clock rate.
DMA REQ	An asynchronous input used to freeze the MPU clocks in the Ø1 high Ø2 low state for cycle steal DMA.
DMA GNT	A synchronous output used to synchronize the DMA operation of the MPU.
MEM RDY	This input is not used.
Ø1, Ø2	Capable of driving the Ø1 and Ø2 inputs on MPU U20 at 1 MHz.
BUS Ø2	An output nominally in phase with MPU Ø2.
MEM CLK	An output nominally in phase with MPU Ø2 which free runs even during the DMA request cycle.
POW RES	A Schmitt trigger input which controls RES OUT. The internal 50 k resistor to Vcc and the external 22 μf capacitor sets the time constant of about 1 second.
RES OUT	The power-on reset output used to initialize the system at power-on.
X1, X2	Provision to attach the 4 MHz series resonant oscillator.
EXT	This input is not used.

6-136. These signals are generated by the 4xfo, 2xfo and MEM CLK outputs of U26. The falling edge of 4xfo triggers the transition of the Q and $\overline{Q}$ outputs of U23. The generation of these signals is illustrated in Figures 6-63 and 6-64. The timing relation between 2xfo, 4xfo and MEM CLK are shown in Figure 6-64. The state table of the actual circuit is shown in Figure 6-64.

6-137. **Data Bus Enable (DBE).** The Ø2+STB is used specifically to generate the rising edge of the DBE (U20-36) (Data Bus Enable) signal. This is done to provide the long data setup time (140 nanoseconds) required by the CMOS latches located on the latch board and elsewhere. The falling edge of DBE is governed by the falling edge of BUSØ2, which occurs approximately 100 nanoseconds after the falling edge of Ø2+STB, thereby supplying ample data hold time for the various latches.

L-788


FV
MEMCLK
2Xfo
4Xfo
U27
U23
PR
J
Q
CK
K
Q̄
CLR
ϕ2+STB
ϕ2-STB
BUS ϕ2
DMAGNT
U21
U27
U21
DBE
1
2
3
4
5
6
15
11
12
13

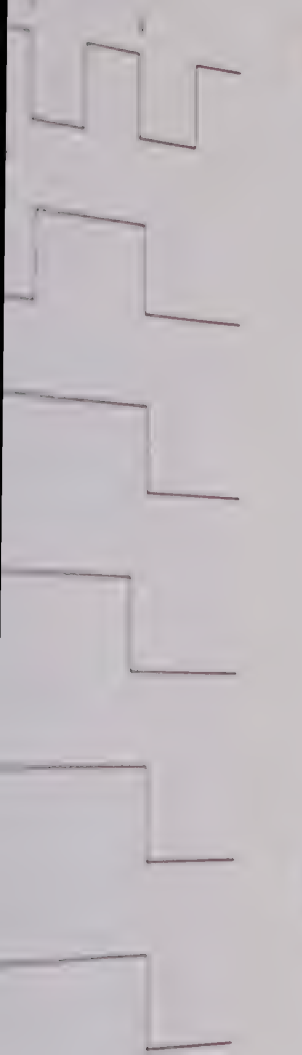


	J	K	Q	Q′
t_1	0	0	0	0
t_2	1	1	0	1
t_3	1	0	1	1
t_4	1	1	1	0

WHERE J = MEMCLK+2Xf0
K = 2Xf0
Q = THE VALUE OF φ2+STB AT TN
Q′ = THE VALUE OF φ2+STB AT TN+TD
TD = THE PROPOGATION DELAY FROM THE CLOCK INPUT TO THE Q OUTPUT.

Figure 6-64. Time Relations, Diagram

L-788



6-138. If the DMAGNT (DMA Grant) signal U26-11 goes high, the DBE signal will not be allowed to go high. This is done to prevent the MPU from enabling its data bus at the same time as the DMA is enabling its data bus.

6-139. The inverse of DBE U27-11, is used to enable the octal transceiver U18 which buffers the data lines of the MPU and DMA from the rest of the system. When the DMASEL line is active (low), U18 will be forced into the disabled mode (U18-9 high). This is done to prevent the bus conflict which would otherwise occur when the MPU is reading data from the DMA. This conflict would be between the DMA data outputs and the U18 receiver drivers.

6-140. **CLOCK OSCILLATOR BOARD P/O A15A1.** (Figures 6-65 and 6-66). The 1 MHz clock oscillator board was designed to substitute for the MC6875 MPU clock generator.

6-141. The major component on the 1 MHz clock oscillator board is the two-phase microprocessor clock driver U1. This device contains the 4 MHz crystal, the oscillator circuit, the NMOS and TTL drivers, and the waveshaping and interface circuitry; all the components necessary to provide the critical non-overlapping two-phase waveforms used by the MPU. It provides the BOS 02, MEMCLK and 4xfc outputs as well. Additional circuitry is used to provide the 2xfc, $\overline{\text{DMAREQ}}$, DMAGNT and the RESET- signals.

6-142. The $\overline{\text{RESET OUT}}$ signal which comes out on pin 14 will be low for about 2 seconds when power is initially applied to the circuit. When capacitor C3 charges sufficiently through resistor R2, the output will go high. The diode CR1 will permit fast discharging of capacitor C3 when power is removed.

6-143. The 2xfc signal is not an output of U1 and had to be created externally. In order to provide the 2xfc signal, two timing requirements had to be met.

a. 2xfc must transition (high to low, or low to high) on the falling edge of the 4xfc signal.

b. 2xfc must be low following the falling edge of the MEMCLK signal.

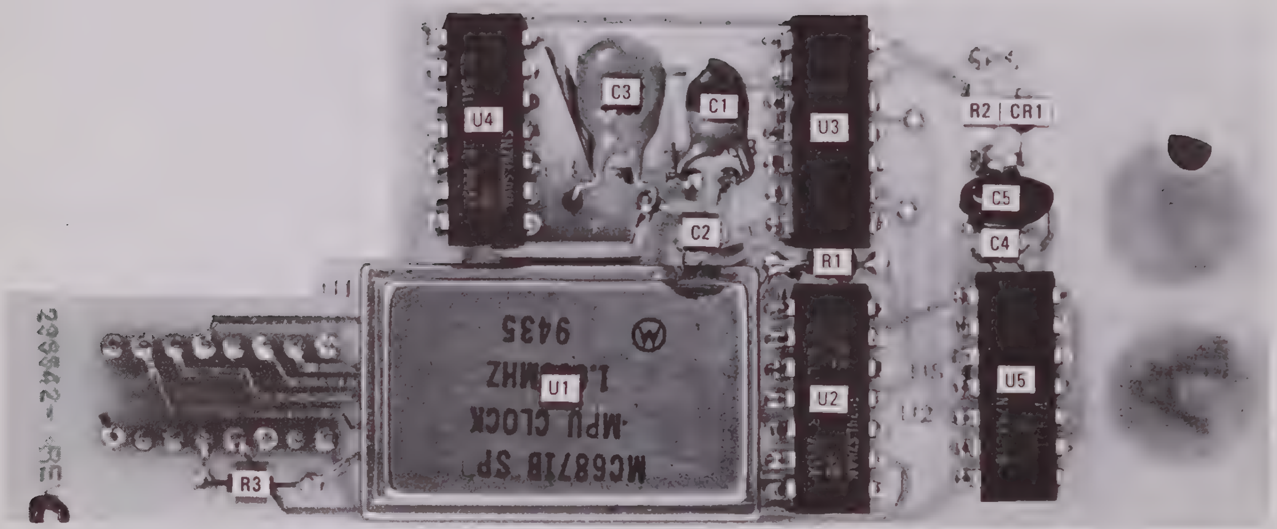


Figure 6-65. 1 MHz Clock Oscillation P/O A15A1, Component Locations

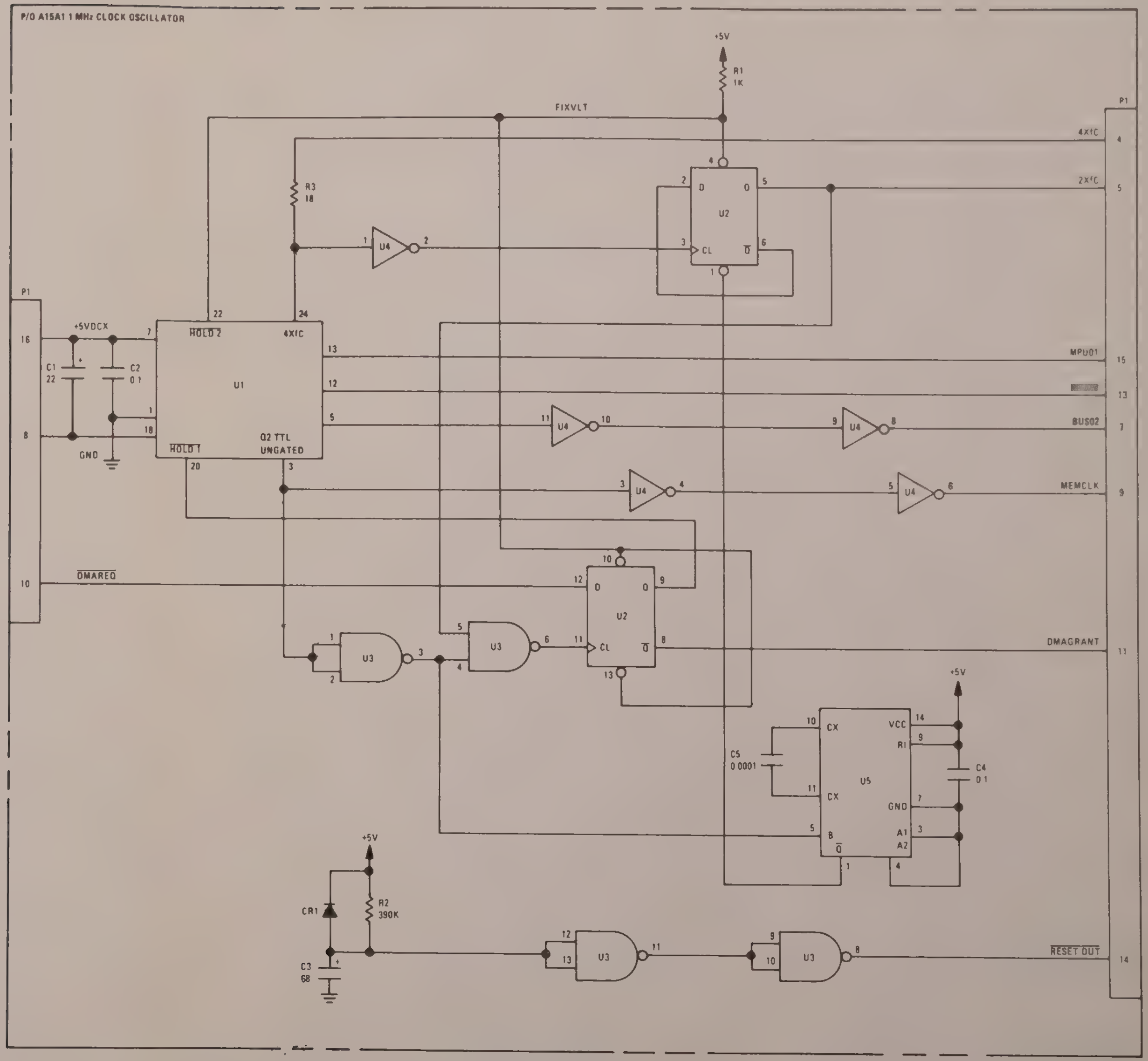


Figure 6-66. 1 MHz Clock Oscillator P/O A15A1, Schematic Diagram

6-148. The inputs to the decoder are ADXA12 through ADXA15 (the high order address lines), VMAXX+ and Ø2-STB (Figure 6-67). The VMAXX+ is the logical OR of VMA from the MPU and TXSTB+ (the inverted $\overline{\text{TXSTB}}$ from the DMA). This signal, when high, enables the two 3-to-8 decoders, U24 and U22. The A, B and C inputs of each of these decoders are driven by ADXA13, ADXA14 and ADXA15 respectively. ADXA12 is used for active low enable of U22-4 directly and the inverted ADXA12 is used for an active low enable of U24-4. This provides a total of 16 decoded outputs of which 15 are used. Most of these outputs are used directly as chip-selects and enables, some must be gated with Ø2-STB. This is done for all the reset signals (RSFPL-, RSEND-, RSPOW-, RSSWP). This is done to prevent spikes which could be generated between cycles, from strobing these reset lines at the wrong time.

6-149. The FPENA- signal U25-8 goes active (low) when any one of three front panel activities are being enabled. These three activities are RDKBD- U24-12 read keyboard, RSFPL- U24-13 reset front panel, and DSPSEL U22-13 display select. The FPENA- signal, when active, will enable the front panel address buffer U4, and the front panel data buffer U3. The front panel address and data buffers are only enabled at these times in order to keep those lines static when there is no communications with the front panel. This was done to minimize noise propagation to the RF systems.

6-150. The RAMSEL signal is generated when either U22-15 or U24-15 go active (low). U22-15 is the normal address decode for RAM. U24-15 is the LATSEL signal (Latch Select) and is made active when data is being written into the data latches. Therefore, whenever data is written into the data latches, it is also written into RAM. This is done to allow the MPU to have access to the data which was written into the frequency data latches during a fast learn sequence.

6-151. **Random Access Memory (RAM).** The RAM used in the 380 consists of two packages which contain 4096 bits of static read/write memory organized in 1024 words by 4 bits.

6-152. The ten address lines (A0-A9) (Figure 6-60) as well as the CS (chip select) and $\overline{\text{WE}}$ (write enable)

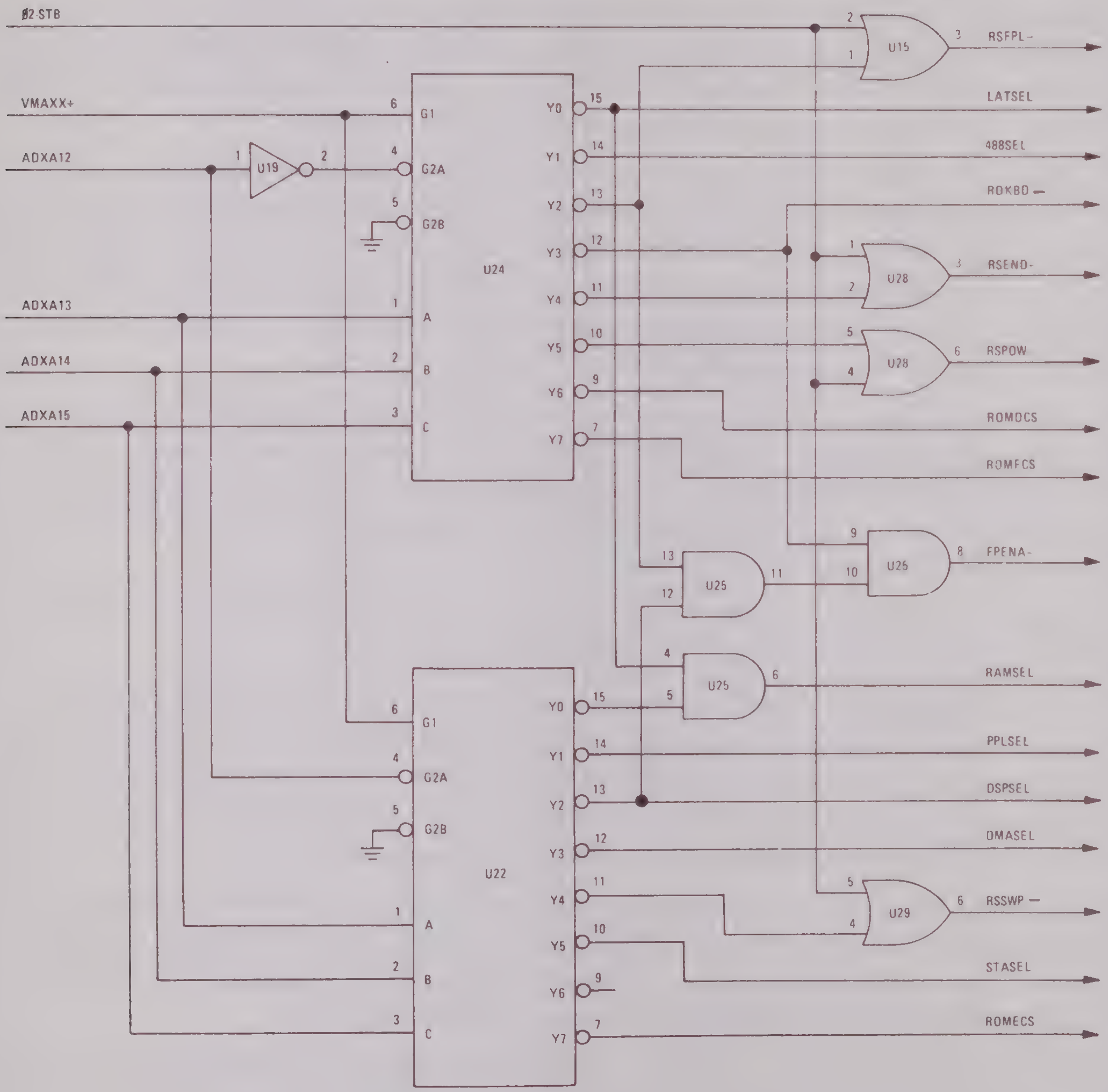


Figure 6-67. Address Decoder, Functional Logic Diagram

6-155. The outputs of the ROM are enabled when a low level signal is applied to the PD/$\overline{PGM}$ (pin 20) input. When this pin goes high, the outputs in a high-impedance state and the active power dissipation of the device is cut by 80%.

6-156. The U14 ROM is selected when the four high order address lines code a hexadecimal D. The U11 ROM is selected with an E and the U6 ROM is selected with an F. The selected ROM outputs will be enabled only if the $\overline{RD/WRT}$ signal is low (read mode).

6-157. The address inputs and data outputs of all three ROM's are commonly bussed, with the exception of A1 through A4 of the U6 ROM. These address inputs come from the priority interrupt controller.

6-158. **Priority Interrupt Controller (PIC).** The priority interrupt controller (PIC-U12) is used to add prioritized response to system interrupts and eliminates the need of polling routines to determine which interrupt has been enabled. The primary purpose of the priority interrupt controller (PIC) is to generate a modified address to ROM in response to prioritized interrupts. With the PIC, each interrupting device is assigned a unique ROM location which contains the starting address of the appropriate service routine. After the MPU detects and responds to an interrupt the PIC directs the MPU to the proper memory location.

6-159. The basic functions of the PIC are shown in Figure 6-68. The 8-bit request register is an edge clocked D-type register with internal 6 k pullup resistors on the interrupt inputs ($\overline{IN0}$ through $\overline{IN7}$). Note the inputs are active low. The interrupt register is loaded on the falling edge of the enable when the PIC is not selected.

6-160. The 1-of-8 priority encoder enables a vector corresponding to the stored interrupt with the highest priority and places it on the vector input port of a data selector. In addition an interrupt request signal $\overline{IRQ}$ is generated to signal the MPU that an interrupt has been detected. The mask location register overides all interrupts with priority below the mask level. The mask can be thought of as a movable partition allowing responses to inputs equal to or greater than the mask value. For example, if the stored mask level

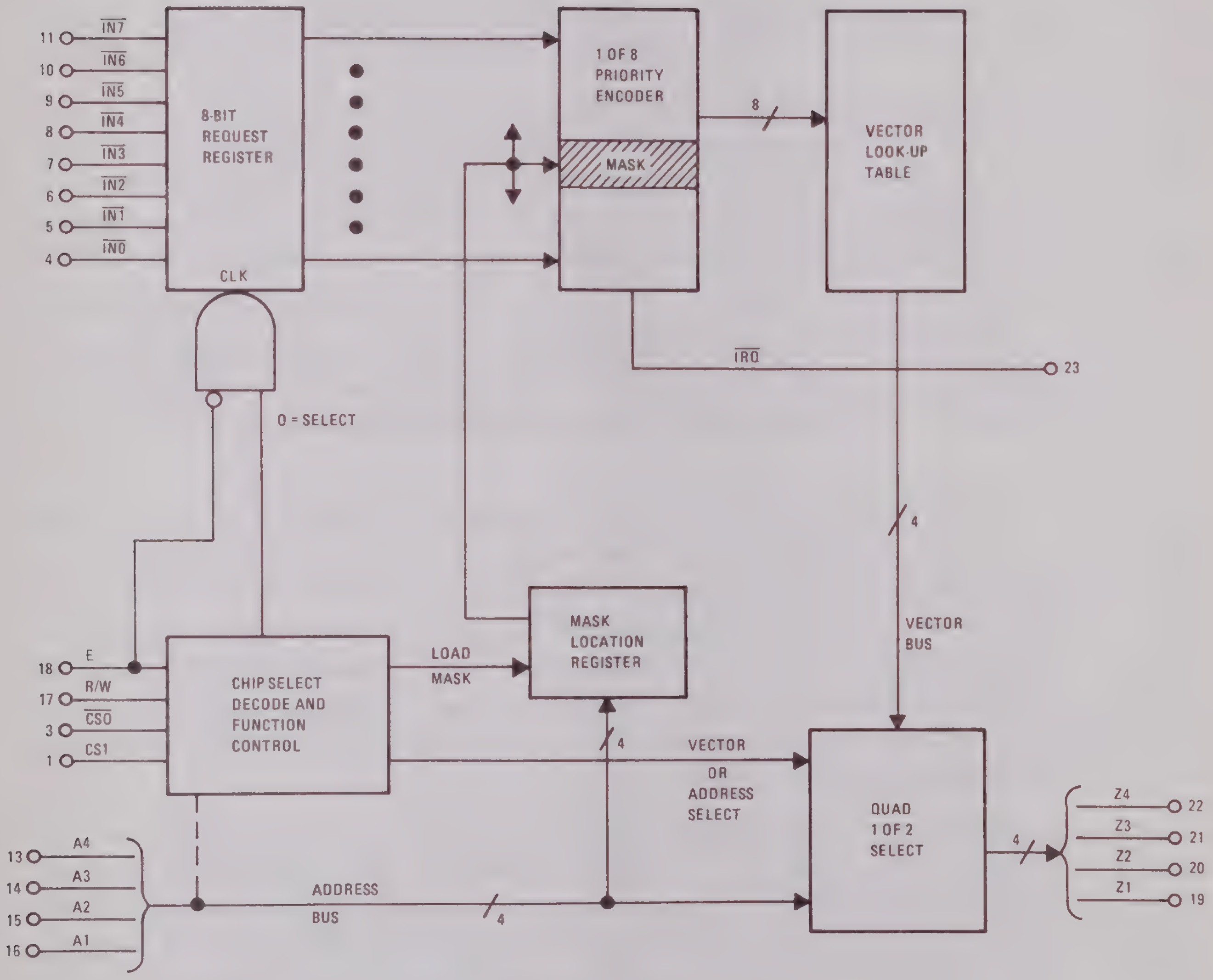


Figure 6-68. Priority Interrupt Controller, Functional Logic Diagram

6-163. When the MPU responds to an interrupt, it attempts to read locations FFF8 and FFF9 (Hex) of ROM to get the vector to the interrupt service routine. The function of the PIC is to modify the FFF8 and FFF9 addresses to the ROM according to which interrupt has caused the $\overline{\text{IRQ}}$ (pin 23) to activate. The only bits which are modified are the A1 through A4 bits. The A5 through A15 bits will enable the PIC when all are high (as when addresses FFF8 and FFF9 are active). Bits A12 through A15 are decoded by the address decoder. An F code on these bits will activate $\overline{\text{CSO}}$ (pin 3). The A05 through A11 are ANDed together (via U2) to create the CS1 enable (pin 1).

6-164. **Data Latches for Attenuation and Modulation Programming Bits.** The data latches for the ten attenuation and fourteen modulation programming bits, resides on the MPU board. The data inputs to these latches come in on the 8 bit bus (DBUS Z0 through DBUS Z7) from the latch board. The latch strobes LSTB08, LSTB09 and LSTB10 also come from the latch board.

6-165. These latches are the CM0S type, 8 bit storage elements with three-state outputs. These outputs have been permanently enabled by tying the OUTPUT DISABLE input (pin 1) to ground. This latch is an 8-bit D type positive edge triggered flip-flop. Data at the D inputs, meeting the set-up and hold time requirements, is transferred to the Q outputs on positive going transitions of the CLOCK input (pin 11).

6-166. In order to insure that all ten attenuation bits change simultaneously, the ATT 1dB through ATT 80 dB bits have a two stage latch. When it is desired to change the output amplitude, the MPU first loads the ATT 1 through 80 dB bits into the first stage latch U8 (LSTB10 is activated). The MPU will then load U10 (by activating LSTB09) with the required ATT +1-, ATT 0.5 dB and MPB-9 through 14 bits. When LSTB09 activates, both U5 and U10 will be loaded, thus loading all ATT bits simultaneously. Due to the slower switching speed of the RF modulator, it is not required to program all MPB bits simultaneously.

6-167. **Power-Down Interrupt Generator.** The power-down interrupt generator (Figure 6-69) will create an interrupt whenever the POWFLG signal is turned off (low). This may happen in one of two ways.

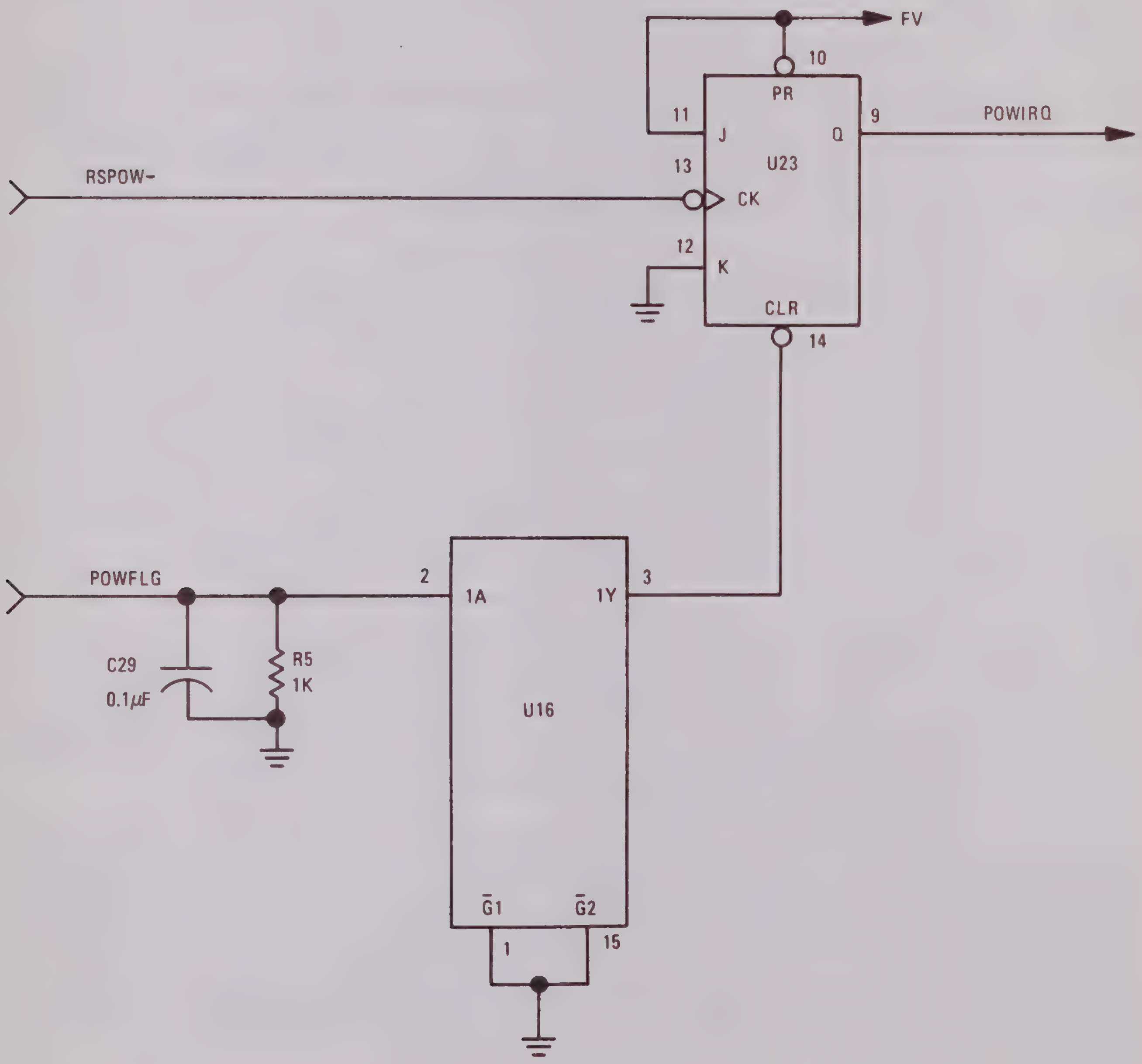
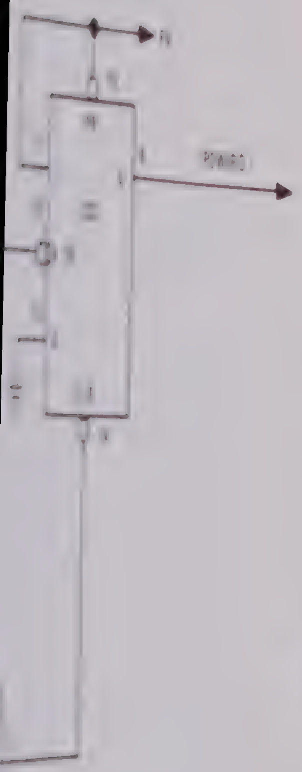


Figure 6-69. Power-Down Interrupt Generator, Functional Logic Diagram



6-169. LATCH BOARD ASSEMBLY A15A2. (Figures 6-70 through 6-72). The primary function of the latch board is to store the 42 frequency bits which are used to drive the remote frequency inputs of the RF plug-in. This board also contains the sweep control circuitry, the sweep voltage generator and the 8 bit system status buffer.

6-170. Latch Data Buffer. The latch data buffer U16 serves to buffer the MPU data bus (DBUSY0-7) from the latch data bus (DBUSZ0-7). The U16 component is an octal buffered latch. The latch is needed to supply sufficient data hold time for the data latches. The outputs of U16 are each tied to a 10K pull-up resistor. This is done to insure that the VIH of the CMOS data latches is met. These outputs parallel feed the data inputs of each primary data latch and the primary sweep latch. The latch enable (G) input is driven by the inverted PRWSTB signal. When PRWSTB pulses low, G pulses high and the input data becomes latched at the Q outputs.

6-171. Latch Address Decoder (U22). The function of the latch address decoder is to create the various clock strobes for the primary data latches. The A, B, C and D inputs to this decoder are driven by the ADXC00 through ADXC03 buffered address lines. The $\overline{G2}$ enable input is driven by the LATSEL (latch select) signal from the address decoder on the MPU board. These signals are normally generated by the MPU, but will be generated by the DMA during a fast-learn transfer sequence. The $\overline{G1}$ enable input is the PRWSTB signal. This signal will pulse low after the ADX and LATSEL signals have settled to their desired levels. This will cause the selected output to pulse low, clocking the appropriate data latch.

6-172. Primary Frequency Latches (U1, 3, 9, 7, 11, 14). These latches are the CMOS 8 bit, D type, positive edge triggered flip-flop. Data at the D inputs, meeting the set-up and hold time requirements, is transferred to the Q outputs on the positive-going transition of the clock input. Each latch, in turn, is loaded with the packed BCD frequency bits. The clock inputs are driven by the outputs of the U22 latch address decoder. The data inputs are driven by the U16 latch data buffer. The OD (output disable) of each latch is wired to ground for continuous operation.

6-176. Sweep Voltage Generator (U23, U5). The sweep voltage generator consists of the ten bit DAC U23, the operational amplifier, U5 and various discrete resistors, inductors, and capacitors. During a sweep, the digital inputs of the DAC will be stepped from all zeroes, corresponding to the start frequency of the sweep, to binary one thousand, corresponding to the stop frequency of the sweep. The step size will be determined by the contents of the step-size register in RAM.

6-177. The I_O1 output of the DAC supplies a negative current (into the DAC) which is proportional to the binary value of the input lines, drives the inverting input of the operational amplifier U5-2. The output of the operational amplifier is the SWPOUT (sweep voltage output) and is tied to the 10K feed back resistor which is internal to the DAC. A 150 pF capacitor is used to suppress output overshoots. The reference voltage for the DAC of -2.046 volts is obtained by the R2, R5 voltage divider fed by the -12VDC input. The R6 potentiometer is the offset trim pot. The 5.2VDCA and the -12VDC voltage inputs are filtered with a series 10μH inductor and a 68μF capacitor to ground.

6-178. Strobe Generator. This circuit will generate the STROBE signal used to clock the secondary frequency latches and the secondary sweep latch. The STROBE signal will be generated by one of three sources. They are the

a. 1 ms Timer
b. FSKSTB
c. LSTB07

6-179. The 1 ms timer (U20) is wired to operate in the astable (free run) mode. The timing components selected (R3, R5, C1) will create a 1 ms pulse train with a duty cycle of 98%. The timer output will do two things. The falling edge will create the rising edge of the STROBE (U21-13) signal, which will clock the data previously loaded in the primary stage to the outputs of the secondary stage. The rising edge of the timer output will generate the active low SWPIRQ signal. This is the sweep interrupt signal which tells the MPU to update the frequency and sweep voltage data in the primary latches. This new data will be transferred to the secondary latch outputs on the falling edge of the next timer pulse output.

6-180. These two events, the creation of the STROBE pulse and SWPIRQ by the timer, will only occur when U6-8 is low. It is made low by the MPU placing a 1 on DBUSZ0 and addressing LSTB13, and will be done when the sweep mode is entered. Note that in the fast-learn mode, when FASTL- goes low, U6-8 is forced high. This insures that the sweep mode is not active when fast-learn transfers are occurring. The SWPIRQ signal is reset by the MPU after the frequency and sweep voltage data has been updated. This is done by the activation of RSSWP-(reset sweep) by the MPU.

6-181. The FSKSTB signal will also generate the STROBE signal. The FSKSTB will go low when either the FSHIRQ or FSLIRQ interrupt signals go active. When FSKSTB pulses low, the STROBE will pulse high, thereby clocking the secondary latches on the leading edge. The data which is in the primary latches was placed there by the MPU when it received the previous FSK interrupt.

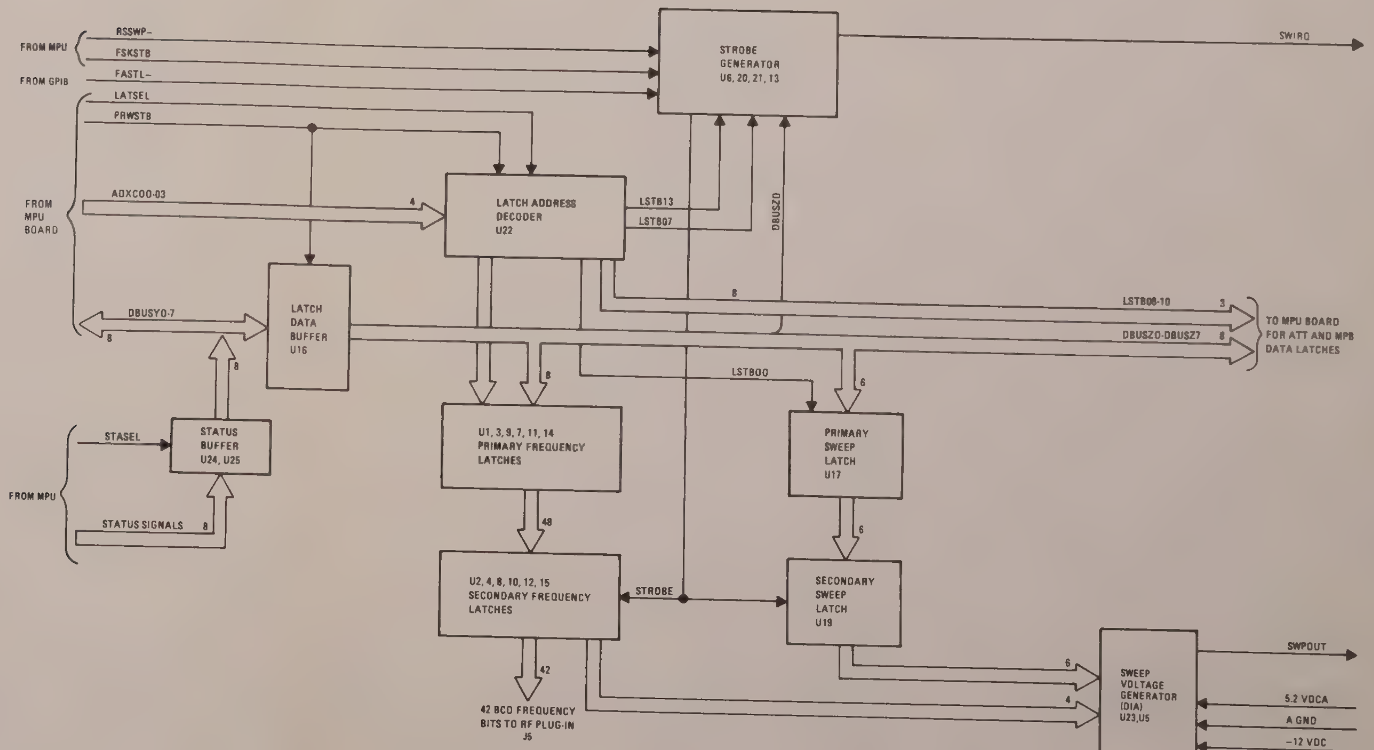
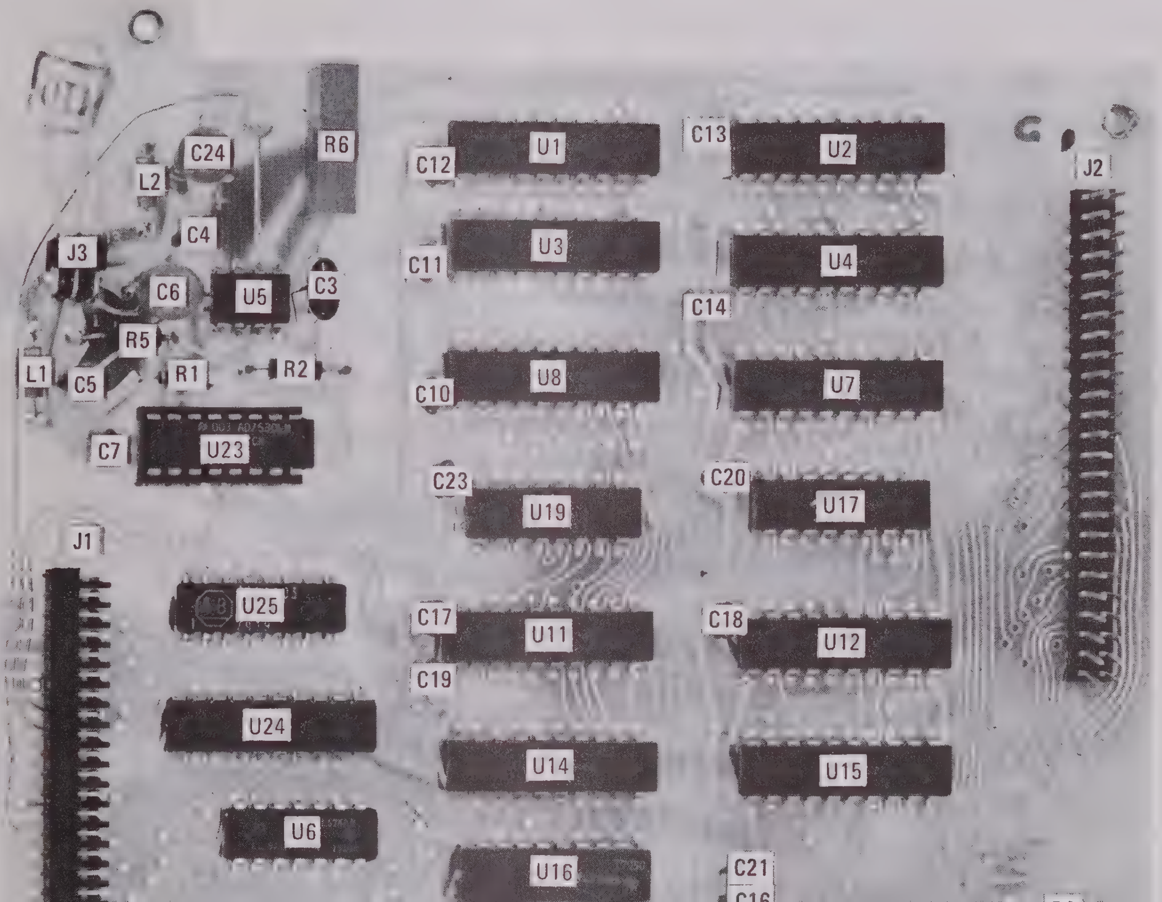

FROM MPU
RSSWP–
FSKSTB
FROM GPIB
FASTL–
LATSEL
PRWSTB
STROBE GENERATOR U6, 20, 21, 13
SWIRQ
FROM MPU BOARD
ADXC00-03
4
LATCH ADDRESS DECODER U22
LSTB13
LSTB07
DBUSZ0
8
LSTB08-10
3
DBUSZ0-DBUSZ7
8
TO MPU BOARD FOR ATT AND MPB DATA LATCHES
DBUSY0-7
8
LATCH DATA BUFFER U16
8
8
LSTB00
6
STASEL
STATUS BUFFER U24, U25
FROM MPU
STATUS SIGNALS
8
U1, 3, 9, 7, 11, 14 PRIMARY FREQUENCY LATCHES
PRIMARY SWEEP LATCH U17
48
6
U2, 4, 8, 10, 12, 15 SECONDARY FREQUENCY LATCHES
STROBE
SECONDARY SWEEP LATCH U19
42
42 BCD FREQUENCY BITS TO RF PLUG-IN J5
6
4
SWEEP VOLTAGE GENERATOR (DIA) U23,U5
SWPOUT
5.2 VDCA
A GND
–12 VDC

Figure 6-70. Latch PC Board A15A2, Block Diagram

L-788


R6
C24
L2
C4
J3
C6
U5
C3
R5
L1
C5
R1
R2
C7
U23
J1
U25
U24
U6
C12
U1
C13
U2
J2
C11
U3
U4
C14
C10
U8
U7
C23
U19
C20
U17
C17
U11
C18
U12
C19
U14
U15
U16
C21
C16

6-182. When the FSHIRQ is received, the MPU will load the contents of the frequency register into the primary frequency latches. When the FSLIRQ is received, the MPU will load the contents of the frequency register plus (+) the contents of the increment register into the primary frequency latches. This data will be transferred to the outputs of the secondary latches on the leading edge of the next FSK interrupt signal.

6-183. The LSTB07 (latch strobe 07) signal is generated by the latch address decoder. When the MPU (or the DMA in fast-learn mode) wishes to load a frequency or sweep voltage into the secondary output latches, it will activate the address of the LSTB07 signal. This will, in turn, generate the STROBE pulse and clock the secondary latches.

6-184. The status buffer is an 8 bit 3-state noninverting buffer. This buffer allows the MPU to read the state of the 8 status signals wired to the inputs of the buffer. The buffer is enabled by the STASEL signal which is generated by the address decoder on the MPU board. The outputs of the buffer are tied into the MPU data bus (DBUSY0 through DBUSY7).

The eight status inputs are:

1. RESLT2 }
2. RESLX1 } From resolution control circuit on encoder board
3. RESLX2 }

4. ATTOPFLG — From plug-in. Will be low when attenuator is installed.
5. MODOPFLG — From plug-in. Will be low when modulator is installed.
6. DOUBLE — From plug-in. Will be low when frequency doubler is installed.
7. FROPX1, — From plug-in. Used to indicate the maximum frequency the
8. FROPX2 plug-in is capable of being programmed to. These lines are coded as follows:

FROPX1	FROPX2	MAX. FREQUENCY
0	0	26 GHz
0	1	2 GHz
1	0	1800 MHz
1	1	180 MHz

6-185. All inputs of the buffer are tied to a 10K pull-up resistor in the U25 resistor network package. This is done to insure that the inputs go high when the ground jumpers are not installed on these status input signals. If the ATTOPFLG and/or the MODOPFLG signal are high, those functions will not be programmable. If both of these signals are high, the RF panel mode will not be entered when prompted from the keyboard. When the DOUBLE signal is low, the frequency programmed will be displayed as entered but will output to the frequency latches at half the entered value.

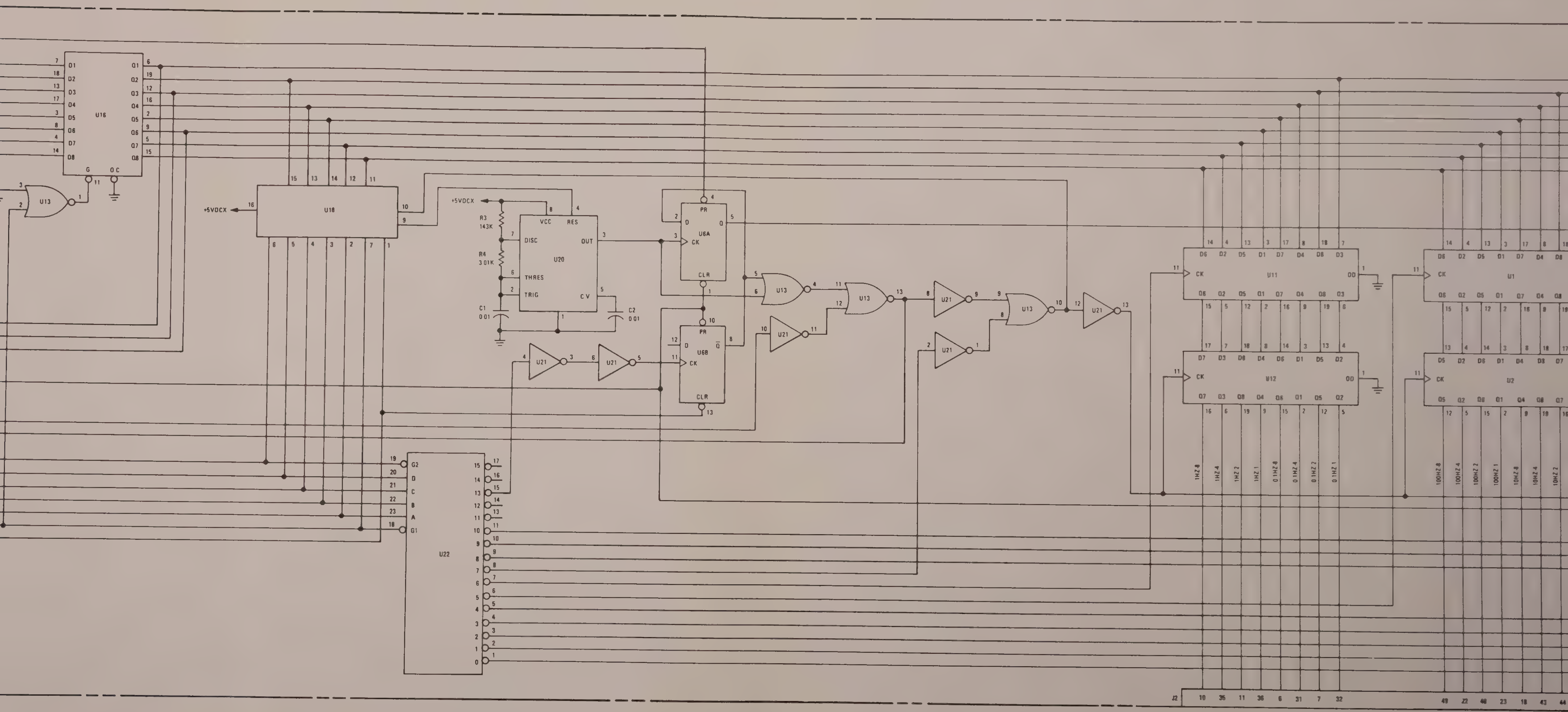


Figure 6-72. Latch PC Board A15A2, Schematic Diagra

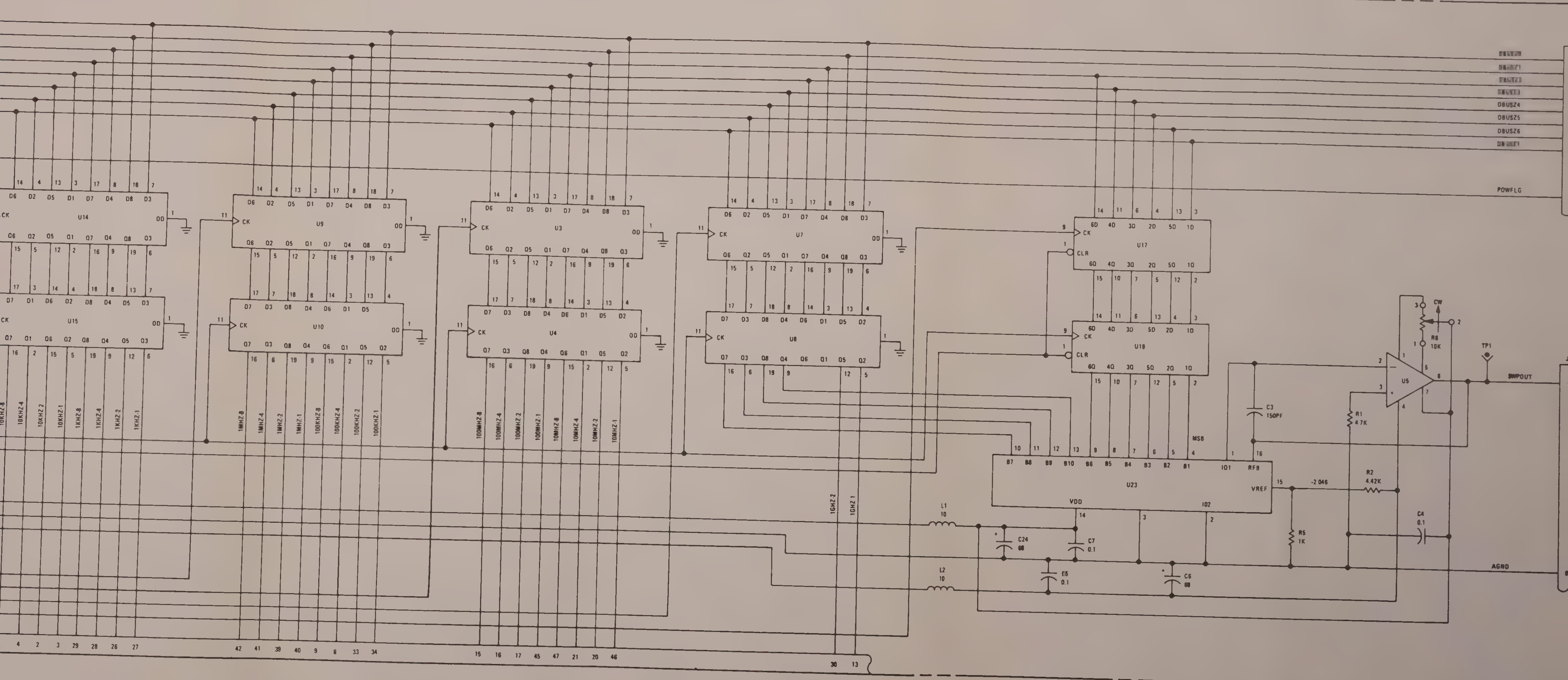


Figure 6-72. Latch PC Board A15A2, Schematic Diagram (Sheet 2)

The resolution signals are coded as follows:

RESLX2	RESLX1	RESLT2	Resolution Hz
0	0	0	1000.0
0	0	1	100.0
0	1	0	100.0
0	1	1	10.0
1	0	0	10.0
1	0	1	1.0
1	1	0	1.0
1	1	1	0.1

6-186. GPIB BOARD ASSEMBLY A15A3. (Figures 6-73 through 6-75). The GPIB board provides the means for interfacing the 380 to the IEEE 488 standard instrument bus, also referred to as the General Purpose Interface Bus (GPIB). Below is a brief description of the GPIB as specified by IEEE Standard 488-1978. For a detailed description of the bus operation, refer to this standard published by The Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, N.Y., 10017. To understand the circuit description of the GPIB board, a full understanding of the Standard 488-1978 is not required but would be useful.

6-187. General Description of the IEEE Standard 488-1978. The IEEE Standard 488-1978 is a byte-serial, bit-parallel interface system primarily defined for programmable measurement instrument systems. The general system defines all circuits, cables, connectors, control protocol and message repertoire to ensure unambiguous data transfer between devices.

c. These lines may employ either open-collector (not open-collector in an absolute sense due to the termination networks on the bus) or three-state drive elements with certain constraints on the SRQ, NRFD, DIO1-8 and NDAC lines.

6-188. **Bus Line Callouts.** Table 6-7 lists the 16 lines defined in the 488 bus and their definitions.

TABLE 6-7. BUS LINE CALLOUTS

Signal Name	Description
DIO1-DIO8 Data Input/Output	These are the message lines for carrying data in a bit-parallel, byte-serial form. Data is asynchronous and generally bidirectional. These lines carry either data or address information, depending on the condition of the ATN line.
DAV (Data Valid)	One of the three handshake lines used to indicate availability and validity of information on the DIO lines. DAV indicates to the acceptor(s) that data is available on the DIO lines.
NRFD (Not Ready for Data)	Another handshake line used to indicate that all devices are or are not ready to accept data.
NDAC (Not Data Accepted)	The final handshake line used to indicate the acceptance of data by all devices.
ATN (Attention)	One of five bus management lines used to specify how data on the data lines are to be interpreted and which devices must respond to the data. When ATN is true the DIO1-8 lines carry addresses or commands. When false they carry data. (controller driven).
IFC (Interface Clear)	A bus management line which is used to place the interface system in a known quiescent state. All interconnected devices contain some portions of the interface system. IFC puts talkers, listeners into their idle states. (controller driven).
SRQ (Service Request)	A bus management line used by a device to indicate a need for service and to request an interrupt of the current events sequence.

TABLE 6-7. BUS LINE CALLOUTS (Cont)

Signal Name	Description
REN (Remote Enable)	This management line in conjunction with other messages selects between two alternate sources of device programming data. (example: front panel control or interface control). (controller driven).
EOI (End or Identify)	The final management line used to indicate the end of multiple byte transfer sequences or with ATN to perform a parallel polling sequence

6-189. General Purpose Interface Adapter (GPIA) U13. U13 is an NMOS General Purpose Interface Adapter (GPIA) that provides the means to interface between the IEEE-488 standard instrument bus and an 8-bit MPU bus. It implements the necessary IEEE state diagrams for the acceptor and source handshake, talker, talker extended*, listener, listener extended*, service request, parallel poll, device trigger*, remote local, and device clear functions. In addition, the part implements other non-IEEE defined functions such as: single and dual primary address recognition*, RFD handshake hold-off, DMA, talk only*, listen only* and programmable interrupts. Many instrument bus protocol features are automatically handled by the device and require minimal MPU response due to the internal registers conveying information on the state of the U13 and GPIB. The device is configured for the desired operation by programming it from the MPU data bus or the IEEE-488 bus.

6-190. The GPIA is designed to be used with an MPU. The MPU is used to program the part (e.g., initial-

TABLE 6-8. GPIB INTERFACE SIGNALS

Signal Name	Description
SIGNAL LINES ($\overline{\text{IB0}}$-$\overline{\text{IB7}}$)	These bidirectional lines allow for the flow of seven bit ASCII interface messages and device dependent messages. Data appears on these lines in a bit-parallel byte-serial form. These lines are buffered by transceivers and applied to the 488 bus (DIO1-DIO8).
BYTE TRANSFER LINES (DAC, RFD, $\overline{\text{DAV}}$)	These lines allow for proper transfer of each data byte on the bus between sources and acceptors. RFD goes passively true indicating that all acceptors are ready for data. A source will indicate the data is valid by pulling $\overline{\text{DAV}}$ low. Upon the reception of valid data by all acceptors, DAC will go passively true indicating that the data has been accepted by all acceptors.
BUS MANAGEMENT LINES ($\overline{\text{ATN}}$, $\overline{\text{IFC}}$, $\overline{\text{SRQ}}$, $\overline{\text{EOI}}$, $\overline{\text{REN}}$)	These lines are used to manage an orderly flow of information across the interface lines.
ATTENTION ($\overline{\text{ATN}}$)	Is sent true over the interface to disable current talkers and listeners freeing the signal lines ($\overline{\text{IB0}}$-$\overline{\text{IB7}}$). During the ATN active state devices monitor the signal path for addressing or an interface command. Data Flows on the signal lines when $\overline{\text{ATN}}$ is inactive (high).
INTERFACE CLEAR ($\overline{\text{IFC}}$)	Is used to put the interface system into a known quiescent state.
SERVICE REQUEST ($\overline{\text{SRQ}}$)	Is used to indicate a need for attention in addition to requesting an interruption in the current sequence of events. This indicates to the controller that a device on the bus is in need of service.
REMOTE ENABLE ($\overline{\text{REN}}$)	Is used to select one of two alternate sources of device programming data, local or remote control.
END OR IDENTIFY ($\overline{\text{EOI}}$)	Is used to signal the end of a multiple byte transfer sequence and in conjunction with $\overline{\text{ATN}}$ executes a parallel polling sequence.

L-788

TABLE 6-8. GPIB INTERFACE SIGNALS (Cont)

Signal Name	Description
TRANSMIT/RECEIVE CONTROL SIGNALS (T/$\overline{\text{R}}$, T/$\overline{\text{R}}$2)	These two signals are used to control the quad transceivers which drive the interface bus. Each transceiver has a separate transmit/$\overline{\text{receive}}$ control pin. These pins can support one TTL load each. The transmit/$\overline{\text{receive}}$ inputs of $\overline{\text{REN}}$, $\overline{\text{IFC}}$, and $\overline{\text{ATN}}$ are hard-wired low to receive. $\overline{\text{EOI}}$ is controlled by T/$\overline{\text{R}}$ 1 through the transceiver allowing it to transmit or receive. T/$\overline{\text{R}}$ 1 operates exactly as T/$\overline{\text{R}}$ 2 except during the parallel polling sequence. During parallel poll $\overline{\text{EOI}}$ will be made an input by T/$\overline{\text{R}}$ 1 while $\overline{\text{DAV}}$ and $\overline{\text{IB0}}$/$\overline{\text{IB7}}$ lines are outputs. During Serial Poll T/$\overline{\text{R}}$ 1 will make $\overline{\text{EO1}}$ an input with $\overline{\text{DAV}}$ and the $\overline{\text{IB0}}$/$\overline{\text{IB7}}$ bus as outputs.

TABLE 6-9. GPIA/MPU INTERFACE SIGNALS

Signal Name	Description
$\overline{\text{D0}}$-$\overline{\text{D7}}$	The bidirectional data lines allow the transfer of data between the MPU and the GPIA. The data bus output drives are three state devices that remain in the

TABLE 6-9. GPIA/MPU INTERFACE SIGNALS (Cont)

Signal Name	Description
GPIA READ/$\overline{\text{WRITE}}$ LINE (R/$\overline{\text{W}}$) (Cont)	for the selection of one of seven write only registers when used in conjunction with the register select lines; RS0, RS1, RS2. A high state on the GPIA Read/$\overline{\text{Write}}$ allows for the selection of one of eight read only registers when used in conjunction with register select lines RS0, RS1, RS2.
GPIA REGISTER SELECT (RS0, RS1, RS2)	The three register select lines are used to select the various registers inside the GPIA. These three lines are used in conjunction with the Read/$\overline{\text{Write}}$ line to select a particular register that is to be written or read.
INTERRUPT REQUEST ($\overline{\text{IRQ}}$)	The $\overline{\text{IRQ}}$ output goes to the NMI interrupt of the MPU. This is an open drain output. The $\overline{\text{IRQ}}$ is set false (low) when an enabled interrupt occurs and stays false until the MPU reads from the interrupt status register.
$\overline{\text{RESET}}$	The active low $\overline{\text{Reset}}$ line is used to initialize the chip during power-on start up. Reset is driven by an external power-up reset circuit.
DMA CONTROL LINES (DMA GRANT, DMA REQUEST)	The DMA request line is used to signal waiting data when BI is set high for a DMA controller. The DMA request line is set high if the BI interrupt flag is set in the interrupt status register (R0W). The DMA request line is cleared when the DMA grant is made true. The DMA grant line is used to signal the GPIA that the DMA controller has control of the MPU data and address lines.
ADDRESS SWITCH ENABLE ($\overline{\text{ASE}}$)	The $\overline{\text{ASE}}$ output is used to enable the device address switch three state buffers to allow the instrument address switch to be read on the MPU bus.
CLOCK INPUT (Clk)	The Clk input is a derivative of the MPU 02 clock. It is designed to operate at clock rates up to 1 MHz.

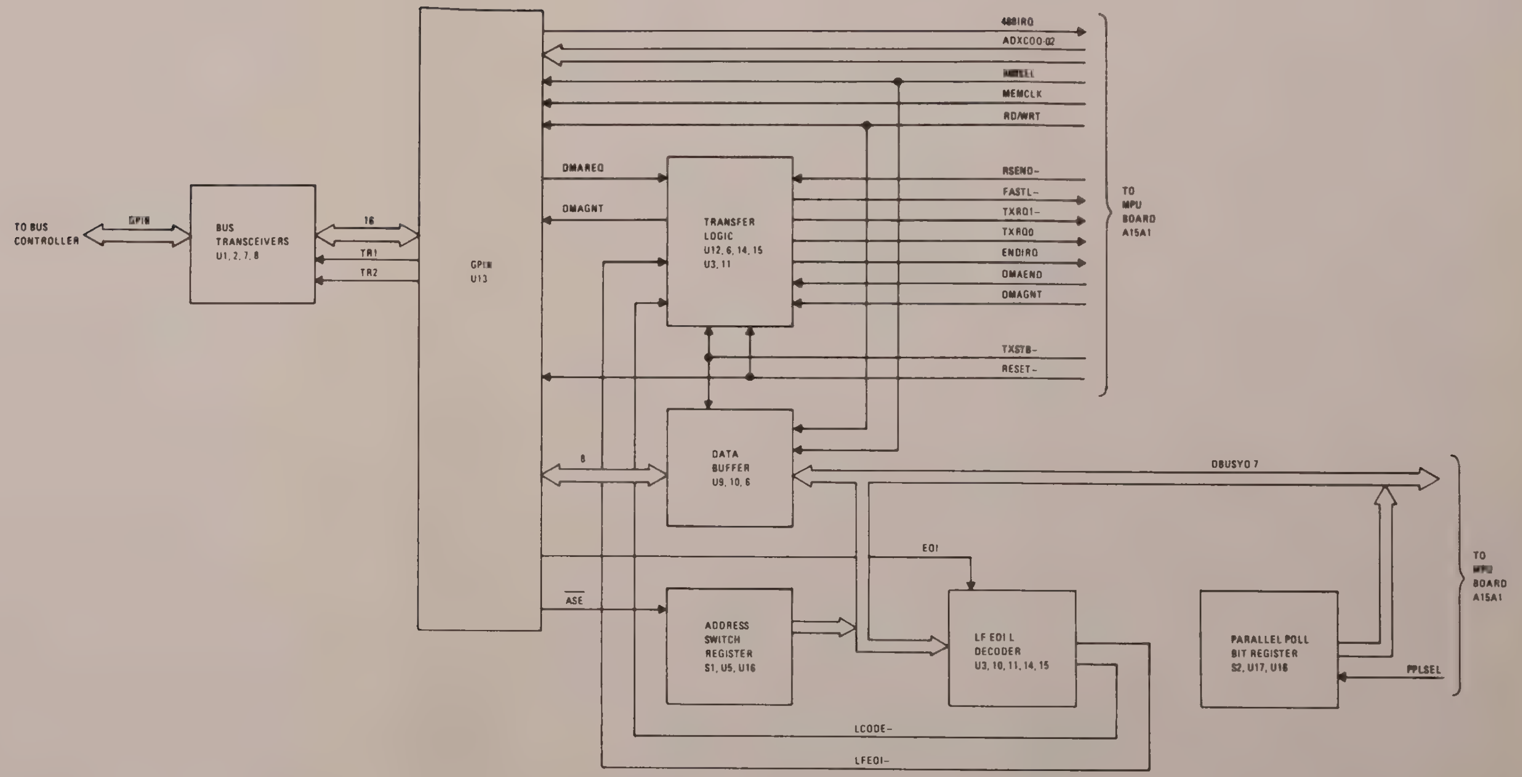


Figure 6-73. GPIB PC Board A15A3, Block Diagram

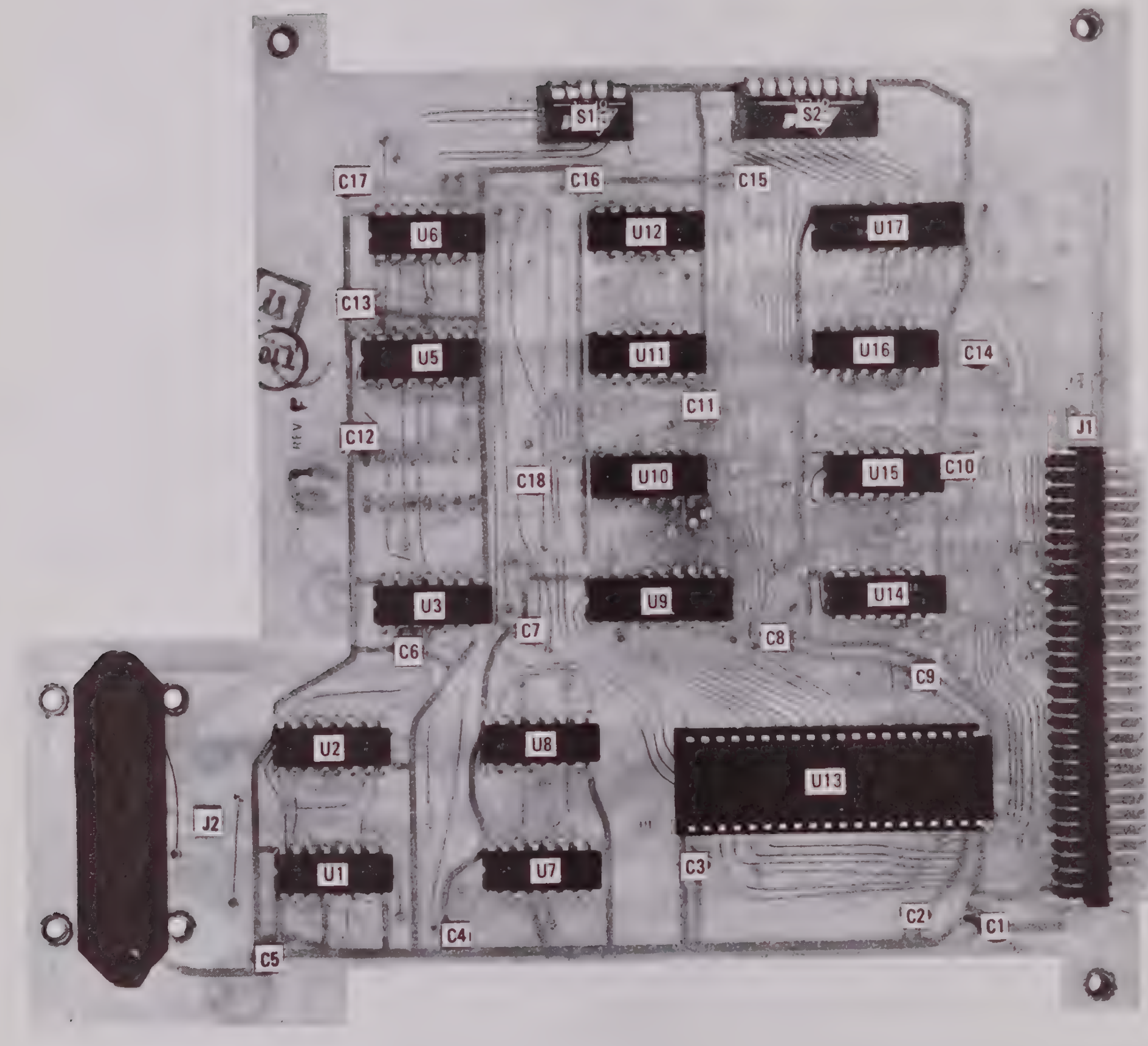


Figure 6-74. GPIB PC Board A15A3, Component Locations

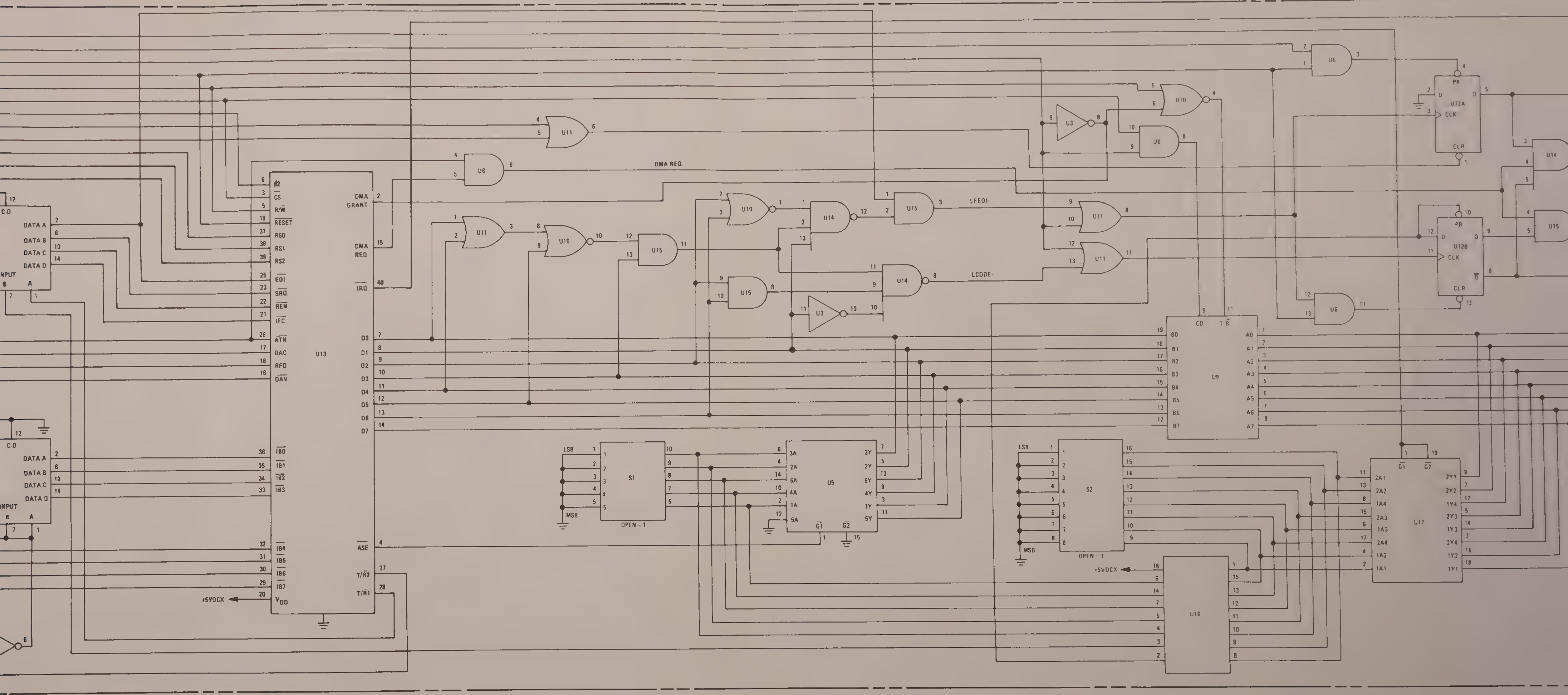
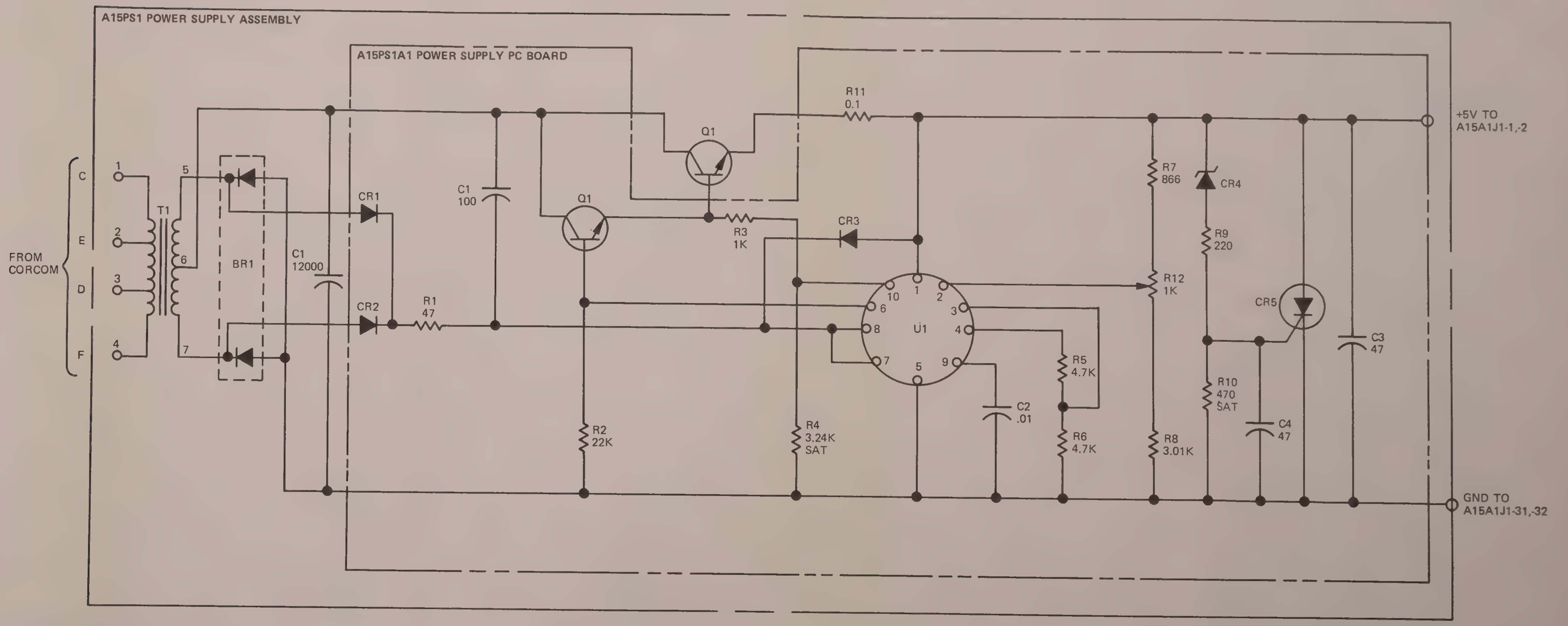


Figure 6-75. GPIB PC Board A15A3, Schematic Diagra



NOTE
UNLESS OTHERWISE SPECIFIED:
RESISTOR VALVES ARE IN OHMS
CAPACITOR VALUES ARE IN µF

Figure 6-76. Power Supply A15PS1, Schematic Diagram

L-788

6-198. If the ASCII character L is being transmitted to initiate the fast learn mode, the LCODE- signal U11-13 will go low and the DMAREQ will go high, activating the TXRQO- signal. The DMA controller will, in turn, activate the TXSTB- signal. On the rising edge of this signal the outputs of U12A will be $\overline{Q}$ U12-8 low and Q U12-9 high. The $\overline{Q}$ output is the FASTL- signal and is used on the latch board to signal the occurrence of the fast-learn mode. This signal is also used to disable the TXRQO-. This is done because in the fast-learn mode all data, except the first character (L), are transferred via channel 1 of the DMA. The Q output of U12 which has gone high, enables the TXRQ1- signal for the next byte transfer. TXRQ1- invokes a channel 1 transfer.

6-199. Channel 1 of the DMA is configured to perform what is called a data chain transfer. The data chain function permits repetitive writing into a block of memory. This allows the GPIB controller to send groups of 7 bytes each after sending an ASCII L. Each of these groups will represent a frequency coded in packed-BCD. The seven byte block of memory is actually the six frequency data latches on the latch board. The seventh byte serves to strobe the frequency to the secondary latch stage for a simultaneous output of all bits. There is a corresponding block of memory in RAM which is simultaneously loaded with the same data that is going into the latches.

6-200. After the seven bytes have been transferred, the DMA will automatically reset its byte count and address register so that the next byte to be transferred will go into the first location of the block. The DMAEND will not be activated as it is with channel O. This technique of directly loading the packed-BCD frequency codes into the latches greatly increases the rate at which frequencies can be loaded into the 380 from the GPIB. The overhead time required to process the data by the MPU is totally eliminated.

6-201. **Linefeed, EOI and L Decode Circuit.** This circuit performs a hardware decode of a LF, EOI and an ASCII L character being transferred via the GPIA.

a. The EOI message, which is generated by the GPIB controller and is an active low uniline

TABLE 6-10. BCD OUTPUT FREQUENCIES

BCD Code				Oscillator Frequency	Output Frequency
1 MHz-1	1 MHz-2	1 MHz-4	1 MHz-8		
0	0	0	0	72	24 MHz
1	0	0	0	75	25
0	1	0	0	78	26
1	1	0	0	81	27
0	0	1	0	84	28
1	0	1	0	87	29
0	1	1	0	90	30
1	1	1	0	93	31
0	0	0	1	96	32
1	0	0	1	99	33

6-214. ISOLATOR/AMPLIFIER A6A3. (Figures 6-77 and 6-81). Q1 and Q2 form an isolator/amplifier for the 24- to 33-MHz signal. The output of the amplifier feeds a bandpass filter consisting of C7 through C11 and L3 through L7. This filter filters out harmonics which appear at its input as well as providing isolation to signals outside the filter bandpass. The level out of this board is a +6 dBm sine wave.

6-215. 366 MHz FILTER CONVERTER A7. (Figures 6-82 and 6-83).

6-216. The 366 MHz filter converter mixes the 337-MHz output from A10J1 with the 29-MHz from the modulation unit producing 366 MHz. The 366-MHz signal is selected by the bandpass filter. The output of the filter is mixed with the 35-36 MHz output from the higher order BCD producing 330-331 MHz for further processing in filter amplifier A9.

6-217. 366 MHz FILTER/CONVERTER INPUT BOARD A7A1. (Figures 6-82 and 6-84). This board mixes the 337-MHz signal from the 337-MHz oscillator isolator with 29 MHz. The 29 MHz comes from an optical modulator in the RF plug-in or from 29-MHz converter A10A6. Mixer M1 produces the sum and difference of these two frequencies. The sum frequency is 366 MHz. L3 and C1 are a resonant circuit tuned to 366 MHz which select the proper input frequency for the two-stage amplifier formed by Q1 and Q2. This amplifier provides a gain of 11 dB, after the mixer conversion loss of 7 dB yielding an overall gain of 4 dB.

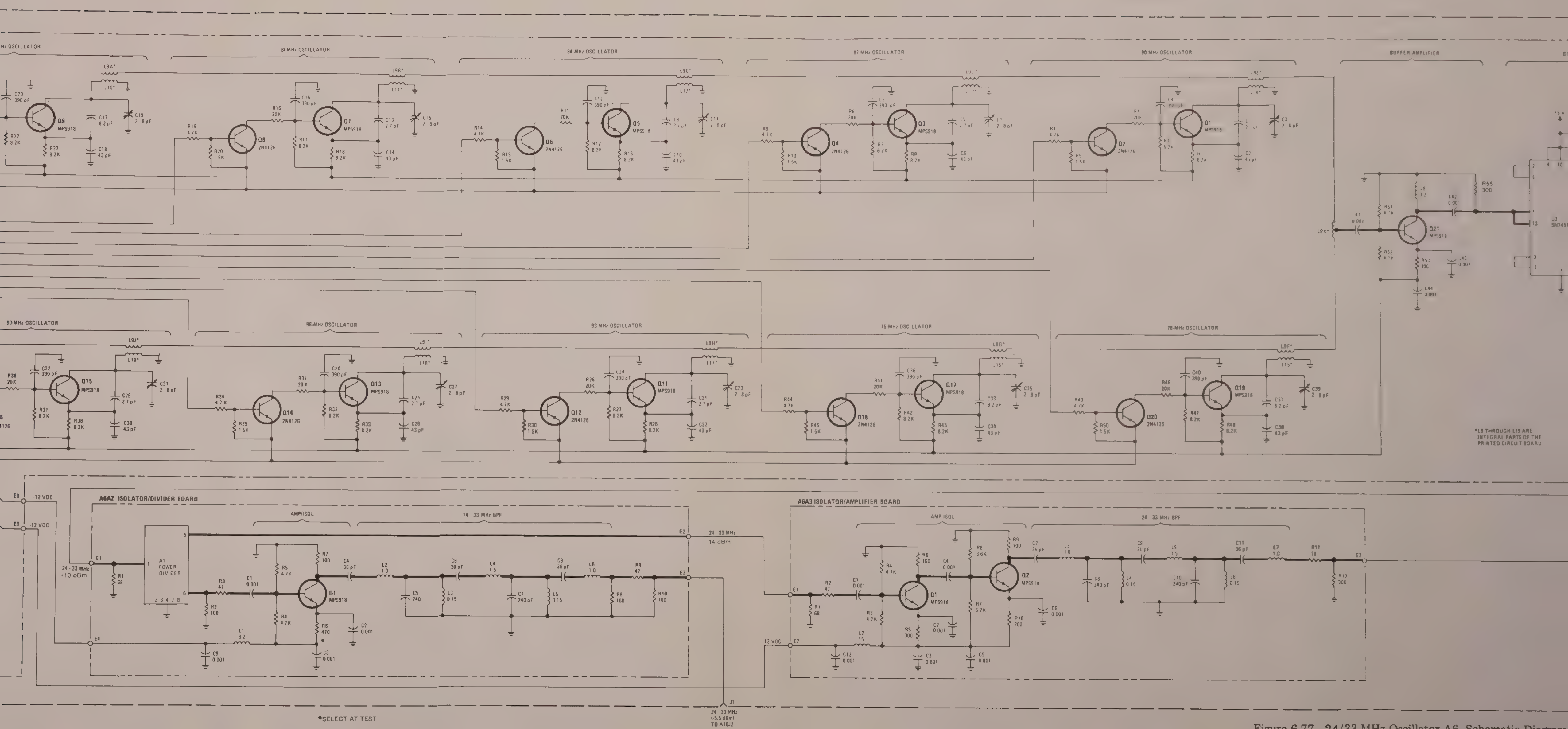
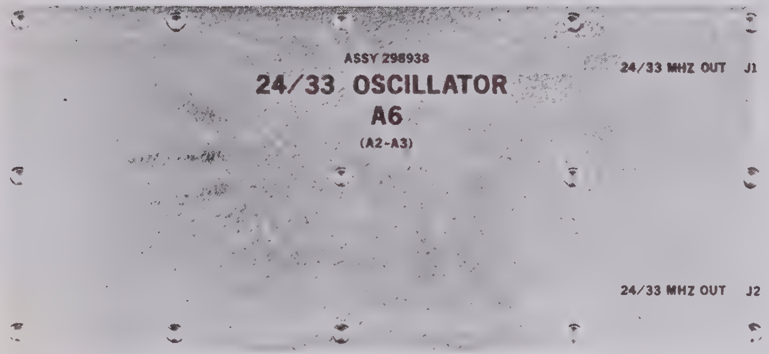
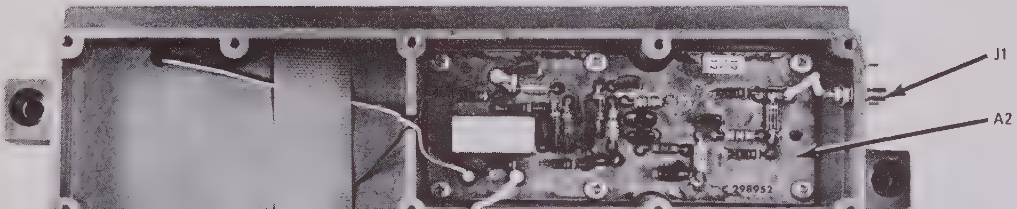


Figure 6-77. 24/33 MHz Oscillator A6, Schematic Diagram

L-788


ASSY 298938
24/33 OSCILLATOR
A6
(A2-A3)
24/33 MHZ OUT J1
24/33 MHZ OUT J2


J1
A2
C 298952

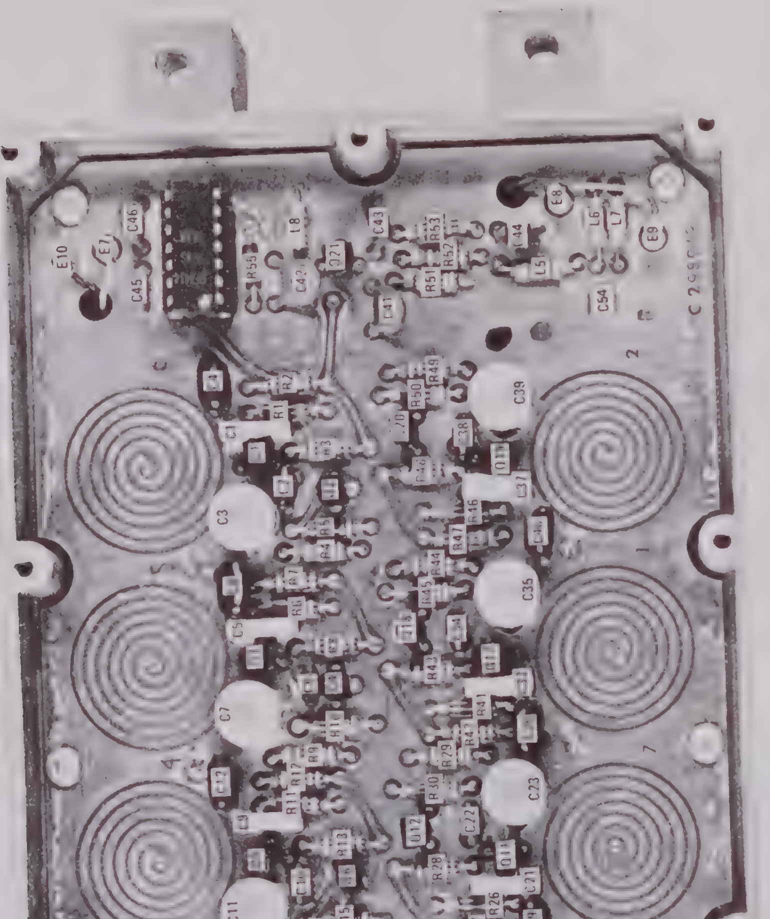


Figure 6-79. 24/33 MHz Oscillator Board A6A1, Component Locations

L-788

Hz Oscillator Board A6A1, Component Locations

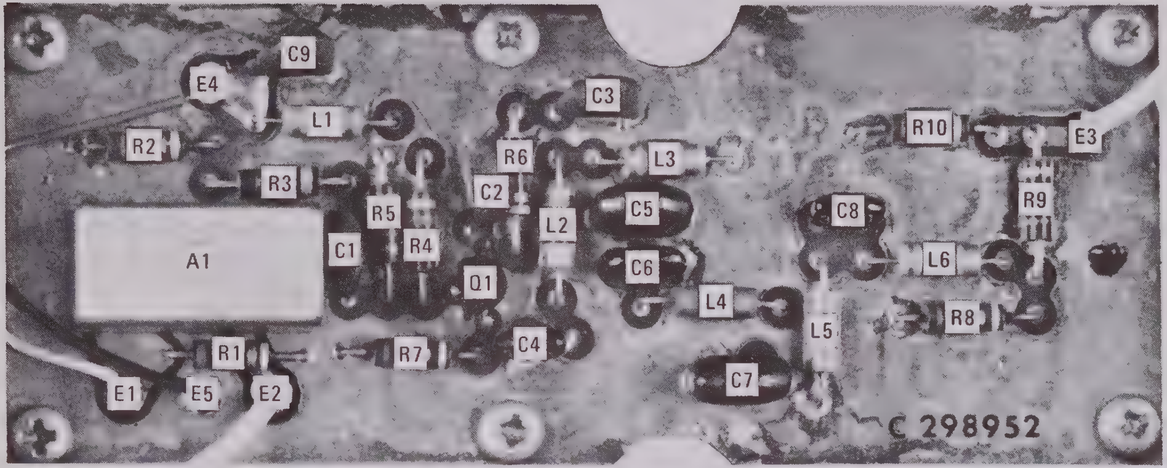


Figure 6-80. Isolator/Divider Board A6A2, Component Locations

6-218. 366 MHz FILTER CONVERTER OUTPUT BOARD A7A2. (Figures 6-82 and 6-85). The 366-MHz signal from the bandpass filter is further amplified by Q3 and Q4 which form a 20-dB gain amplifier at 366 MHz. The output of this amplifier is at a level of +7 dBm to drive the local oscillator input of mixer M2. The 35/36 MHz from BCD section A4 is applied to a 35/36 MHz bandpass filter consisting of C19 through C22 and L7 through L9. This filter removes the 8.75 to 9 MHz sidebands which appear on the BCD output. This filtered 35/36-MHz signal is mised with the 366-MHz signal in M2 to produce sum and difference frequencies. This signal is applied to 330/331 MHz filter amplifier A9 which selects the difference frequency 330/331 MHz.

6-219. 366 MHz BANDPASS FILTER. (Figure 6-82). This is an 1/8 wavelength stripline bandpass filter tuned to 366 MHz. The insertion loss is 7 dB. It has a 3-dB bandwidth of approximately 3 MHz and provides greater than 80-dB rejection bandwidth of 58 MHz. This in a combination with the tuned amplifiers provides the filtering required for 100-dB spurious performance.

6-220. 361/370 MHz FILTER AMPLIFIER A8. (Figures 6-86 and 6-87).

6-221. The 361/370 MHz filter takes the output from the mixer on board A10A2 which heterodynes the 337 MHz with the output of the 24 to 33 MHz oscillator producing 361-370 MHz. The upper sideband generated in this mixer is selected by the band-pass filter.

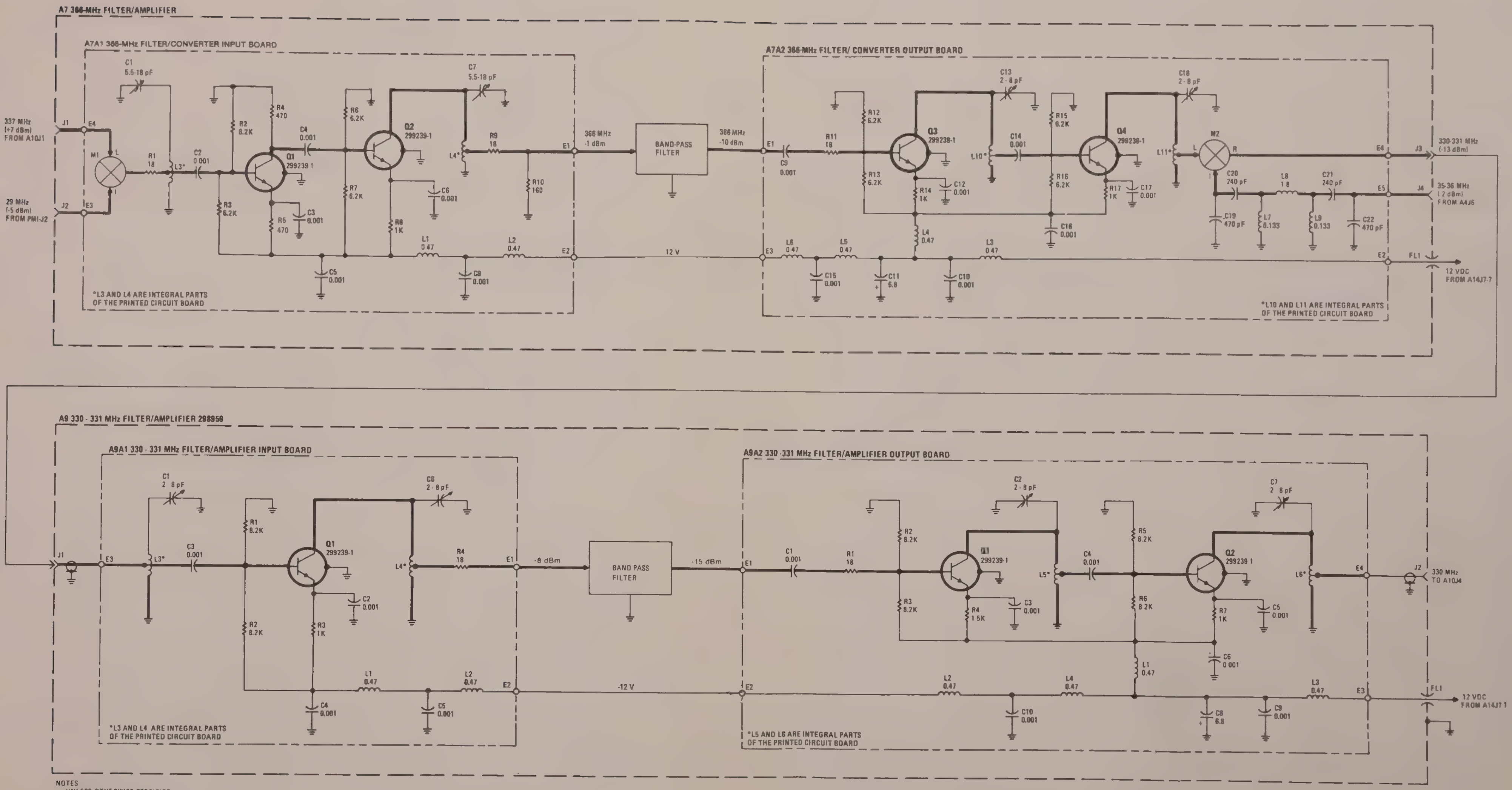
6-222. 361/370 MHz INPUT BOARD A8A1. (Figures 6-86 and 6-88). Input board A8A1 amplifies the input signal by 5 dB. Resistors R1 and R2 form a 3-dB pad to terminate the mixer output. Capacitor C1 and inductor L3 form a 365-MHz resonant circuit to select the correct signal for the amplifier input. Transistor Q1 has a gain of 8 dB at 365 MHz. C5 and L4 tune this amplifier and provide impedance matching at the output.

6-223. 361/370 MHz OUTPUT BOARD A8A2. (Figures 6-86 and 6-89). Output board A8A2 provides 15 dB of gain also tuned to 365 MHz. Amplifier Q1 is tuned by the resonant circuit formed by C4 and L8. The output of Q1 is coupled through C5 into a similar circuit. Q2 is the amplifier; C7 and L9 are the resonant circuits. Inductors L3, L4, and L5 and capacitors C9 and C10 comprise a 400-MHz low-pass filter to further reject the second harmonic of the output signal. Resistors R8 and R9 form a 3-dB pad. The output of this board goes to the RF input of mixer A10A4.

6-224. 361/370 MHz BANDPASS FILTER. (Figure 6-86). This board is a 7-pole bandpass filter covering the band from 361 to 370 MHz. The insertion loss is approximately 10 dB. This filter, in conjunction with the selectivity of the input and output amplifiers, provides 100-dB rejection at 337 MHz and below.

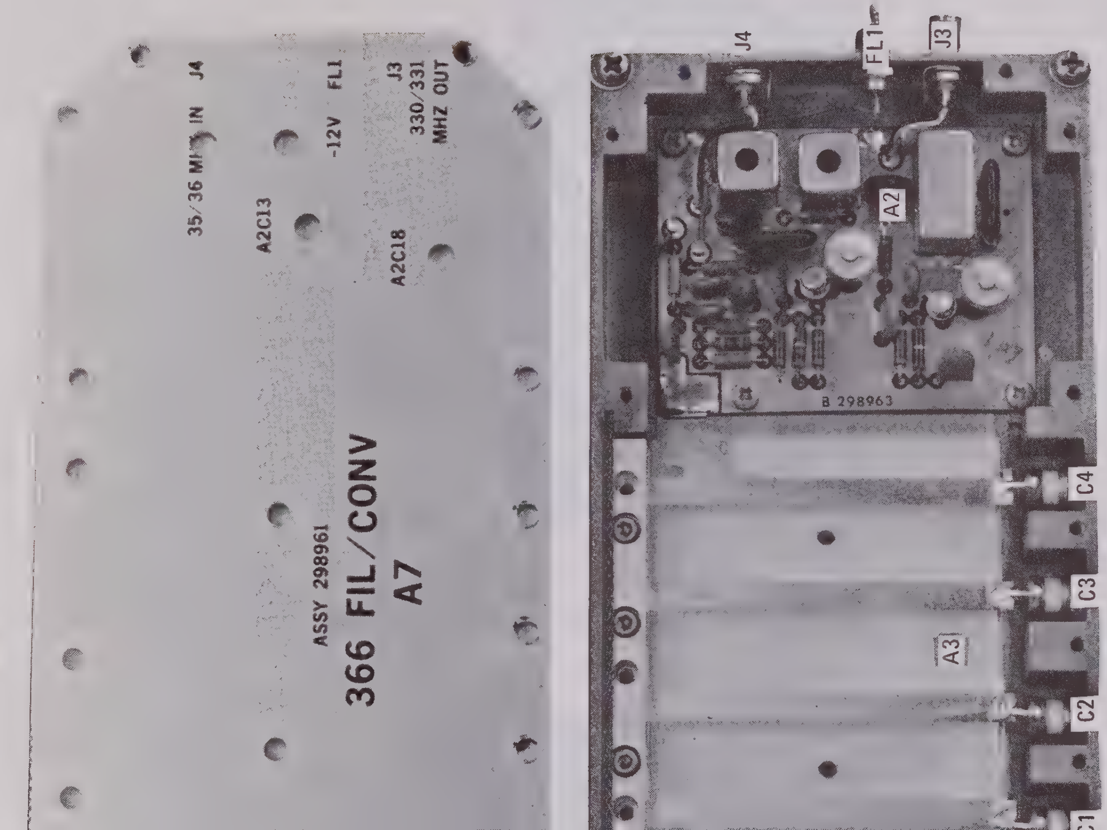
6-225. 330-331 MHz FILTER AMPLIFIER A9. (Figures 6-82 and 6-90).

6-226. The 330-331 MHz filter amplifier selects the 330- to 331-MHz lower sideband from the mixer in filter converter A7.



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN µF
INDUCTOR VALUES ARE IN µH

Figure 6-82. 366 MHz Filter Converter A7 and 330/331 Filter Amplifier A9, Schematic Diagram



6-83. 366 MHz Filter Converter A7

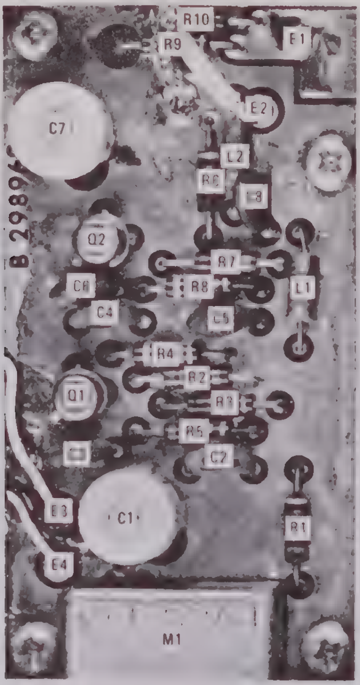


Figure 6-84. 366 MHz Filter Converter Input Board A7A1, Component Locations

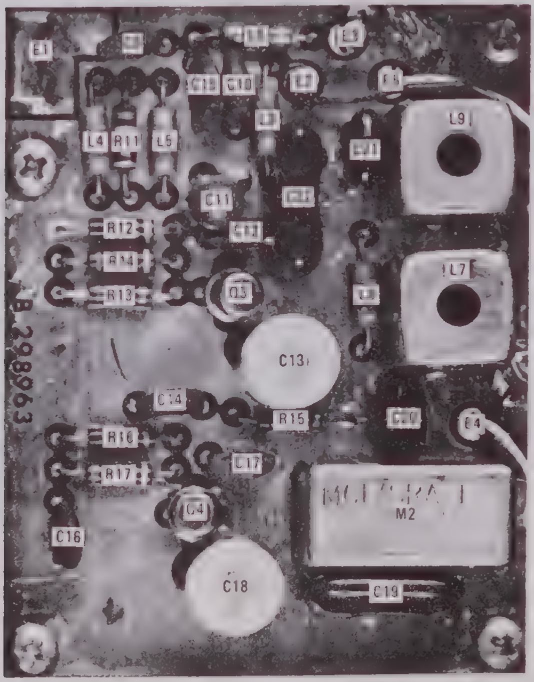
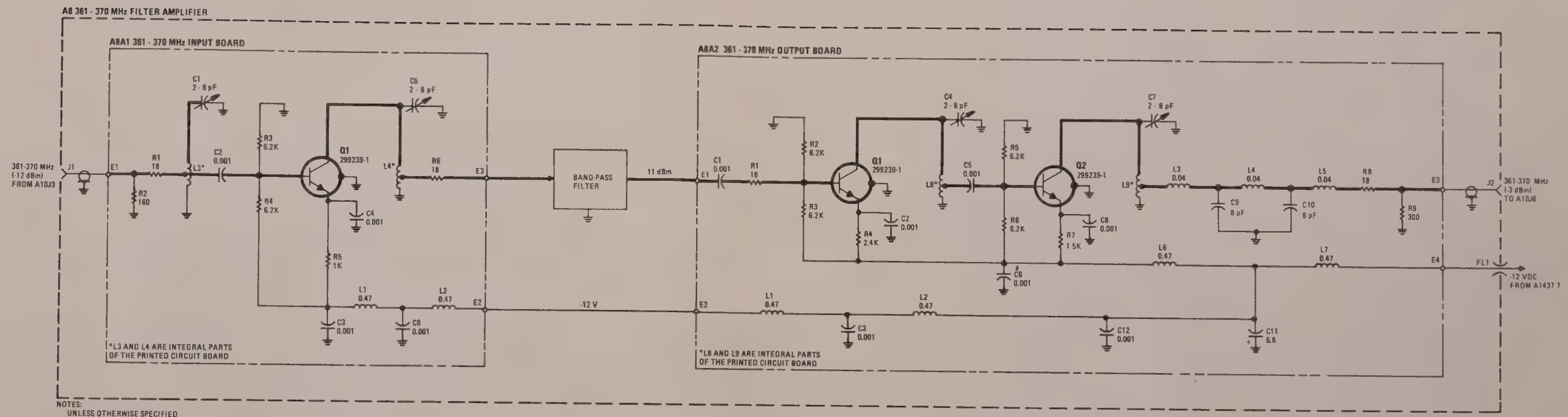


Figure 6-85. 366 MHz Filter Converter Output Board A7A2, Component Locations



NOTES:
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-86. 361/370 MHz Filter Amplifier A8, Schematic Diagram

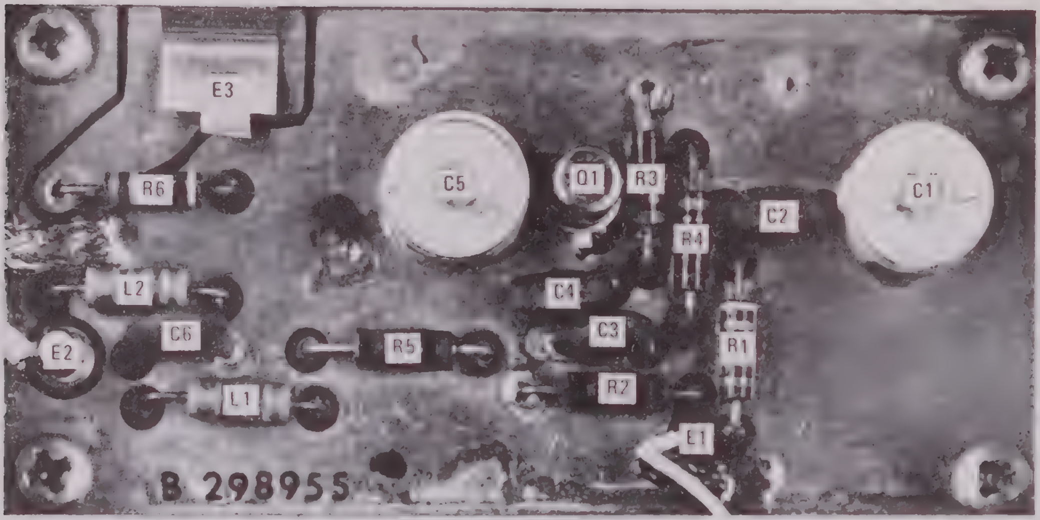


Figure 6-88. 361/370 MHz Filter Amplifier Input Board A8A1, Component Locations

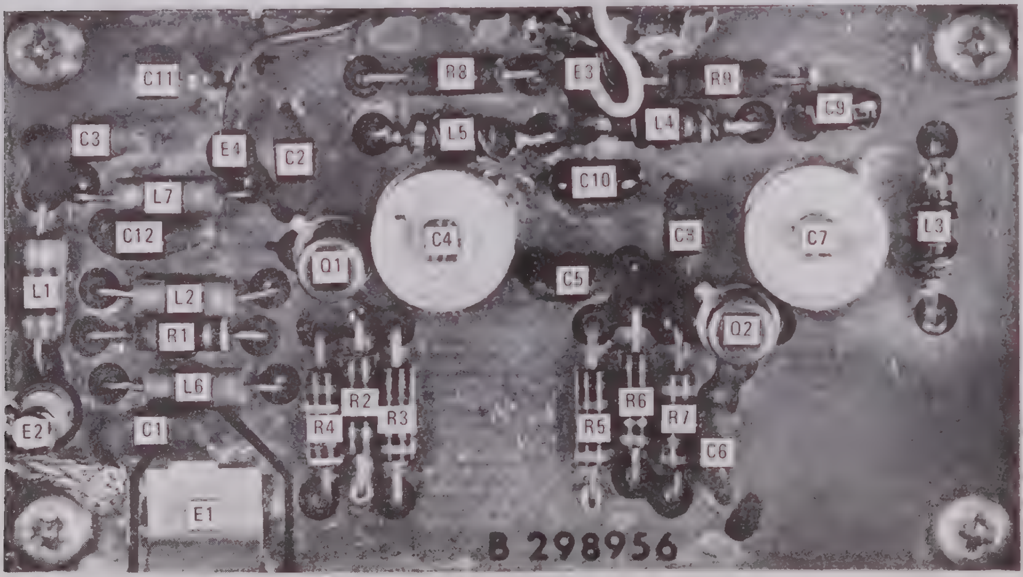
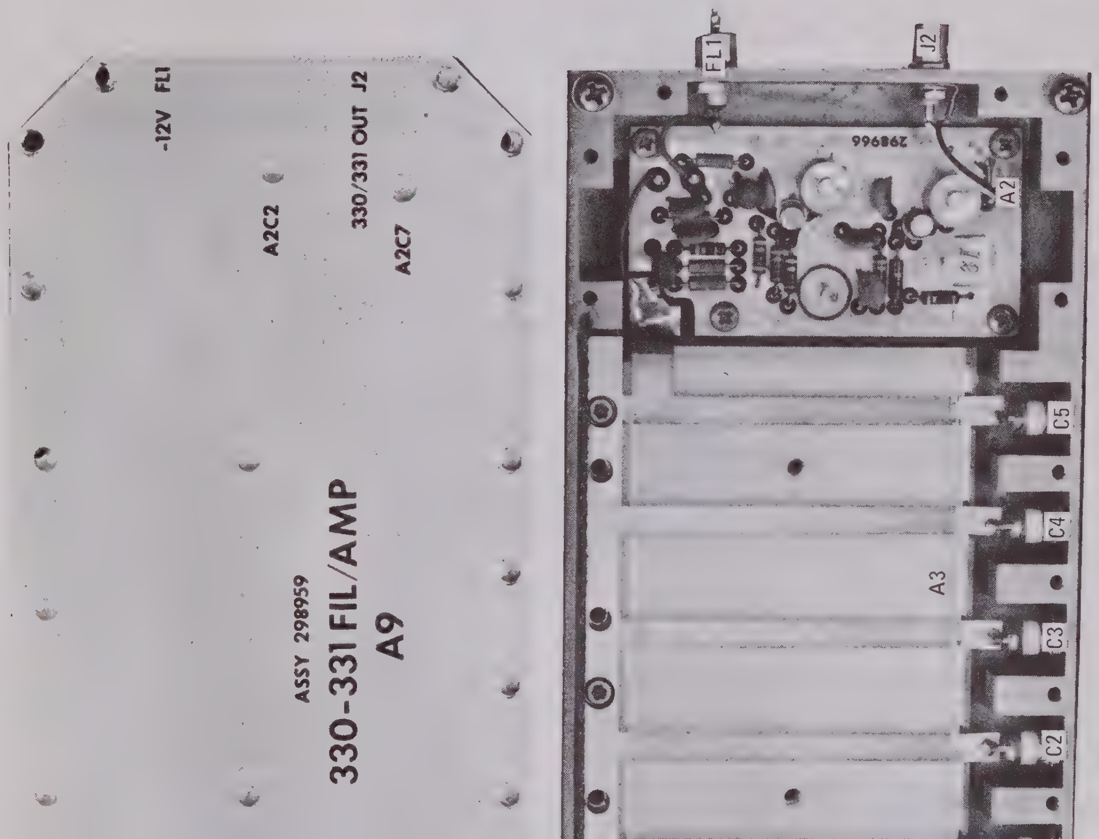


Figure 6-89. 361/370 MHz Filter Amplifier Output Board A8A2, Component Locations



6-90. 330-331 MHz Filter Amplifier A9

6-227. 330-331 MHz FILTER AMPLIFIER INPUT BOARD A9A1. (Figure 6-91). L3 and C1 form a resonant circuit tuned to 330.5 MHz to select the proper input for transistor amplifier Q1. Q1 is a 10-dB gain amplifier at 330.5 MHz tuned by the resonant circuit L4 and C6. The amplified signal is applied to narrowband bandpass filter at 330-331 MHz.

6-228. 330-331 MHz FILTER AMPLIFIER OUTPUT BOARD A9A2. (Figure 6-92). Transistors Q1 and Q2 form a 20-dB gain tuned amplifier at 330.5 MHz.

6-229. 330-331 MHz BANDPASS FILTER. (Figure 6-82). This unit is a 5-pole stripline bandpass filter having a 3-dB bandwidth of greater than 3 MHz. It provides 90 dB of rejection at 366 MHz so that in combination with the tuned amplifiers the 100-dB spur performance is guaranteed.

6-230. HIGH FREQUENCY SUBASSEMBLY A10. (Figures 6-93 and 6-94).

6-231. The high frequency subassembly houses all the remaining printed circuit boards used in the frequency extender.

6-232. 337 MHz OSCILLATOR/ISOLATOR A10A1. (Figures 6-93 and 6-95). This board contains a 112.3333 MHz crystal oscillator, a times three multiplier, and a four-stage active isolator. Y1 is a 112.3333 MHz crystal in an oscillator circuit formed by Q1 and associated components. Q2 is a 112-MHz amplifier which buffers and amplifies the oscillator output. Q3 and Q4 multiply this signal X3 producing 337 MHz.

6-233. At this point the 337-MHz signal is split two ways to drive two active isolators. One isolator is A10A2; the other is on this board. The isolator consists of four tuned amplifier stages followed by a 400-MHz low-pass filter. Amplifiers Q5-Q8, are tuned by the LC circuits on each collector. The tuning capacitors for the isolator are C22, C26, C30, and C34, respectively. Each amplifier is separated by a resistive attenuator to increase the reverse isolation. Capacitors C36, C38, C39, and inductors L17, L18, and L19 comprise a 400-MHz lowpass filter to reject harmonics of the 337-MHz signal. The output level at A7J1 is +7 dBm.

6-234. 337 MHz ISOLATOR BOARD A10A2. (Figures 6-93 and 6-96). This board contains an active isolator similar to A10A1. There are four, tuned-amplifier stage attenuators. Each stage provides gain in the forward direction and about 20-dB isolation in the reverse direction. The stages are separated by resistive attenuators providing increased isolation. The signal from the 337-MHz oscillator board is applied to the input attenuator formed by R1 and R2. It is amplified by common emitter stage Q1. The collector of Q1 is tuned by L9 and the parallel combination of C4 and C5.

6-235. The output of Q1 goes through three more similar stages: Q2, Q3, and Q4. Each stage provides about 20-dB reverse isolation. The tuning capacitors are C5, C9, C15, and C20. Each one is tuned for a maximum output at the mixer local oscillator input. The output of the last stage feeds a 400-MHz lowpass filter consisting of L6 through L8 and C23 through C25. The output of the filter drives mixer M1. The other input to M1 comes from 24/33 MHz oscillator at A6J1. Mixer M1 combines two signals producing sum and difference frequencies. The upper sideband, 361-370 MHz, is selected by 361-370 MHz bandpass filter A8.

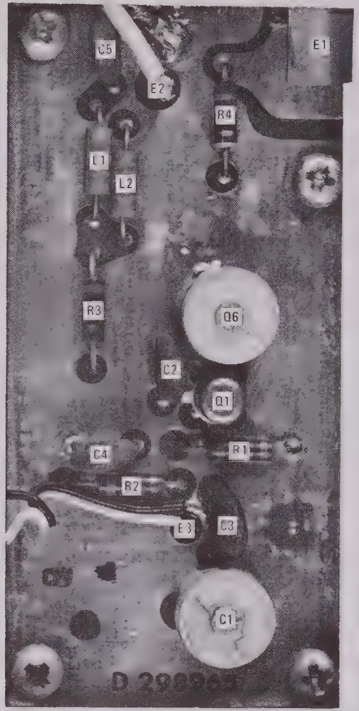


Figure 6-91. 330-331 MHz Filter Amplifier Input Board A9A1, Component Locations

6-236. 30-40 MHz BANDPASS FILTER A10A3. (Figures 6-97 and 6-98). The 30-40 MHz bandpass filter selects the lower sideband of the A10A2 mixer output and provides 14-dB gain for the desired signal. It consists of two identical bandpass filters with an amplifier separating the two. The first filter is formed by C1, C2, C3, C5, L1, L2, and L3. Transistor Q1 and associated components comprise the amplifier which drives the output filter formed by C7-C10 and L4-L6. The input and output impedance of this board are 50 ohms.

6-237. 330.5 MHz POWER AMPLIFIER A10A4. (Figures 6-97 and 6-99). This unit amplifies the output of 330-331 MHz bandpass filter A9 to a level of +17 dBm, which is the local oscillator input to M1. The output of 361-370 MHz bandpass filter A8 is mixed with the signal in M1, producing the sum and difference frequencies. The 30-40 MHz difference frequency is the desired output of the frequency extender. Board A10A3 amplifies the 30-40 MHz and rejects all other mixer outputs.

6-238. The amplifier portion of this board consists of three stages. The first stage formed by Q1 and associated components is tuned by C9 and L7 providing 10 dB of gain at 330.5 MHz. This feeds 6-dB gain amplifier Q2 which is tuned by C10 and L8 to 330.5 MHz. The third 6-dB gain amplifier, Q3, develops the final power which is tuned by C14 and L9. The harmonics of final signal are removed by the 400-MHz lowpass filter formed by L4, L5, L6, C11, and C12. The signal from the local oscillator drives mixer M1 which mixes with the 361-370 MHz producing 30-40 MHz. The mixer IF output passes through a 6-dB attenuator. The output of the board is applied to A10A3.

6-239. 1-5 MHz COMB GENERATOR A10A5. (Figures 6-100 and 6-101). This board contains a programmable divider and lowpass filters. It generates dc, 1, 2, 3, 4, or 5 MHz depending on the 1-MHz frequency control BCD digit. The 1-MHz digit appears on E1, E2, E3, E4, and A10 FL7, FL8, FL9, FL10, respectively. These logic signals are applied to the Prom U1 which controls the programmable divider consisting of 4 dividers U2, U3, U4 and U5. Table 6-11 shows the truth table for Prom U1.

TABLE 6-11. PROM A10A5 U1 TRUTH TABLE

BCD Digit	Input Code				Divider Function	U1-1	U1-2	U1-3	U1-4	U1-5	U1-6	U1-7	Fout
	E4	E3	E2	E1									
0	0	0	0	0	12	1	0	1	0	0	0	1	5 MHz
1	0	0	0	1	15	1	0	1	0	0	1	1	4 MHz
2	0	0	1	0	20	0	1	1	0	1	1	0	3 MHz
3	0	0	1	1	30	0	1	1	0	1	1	1	2 MHz
4	0	0	0	0	60	0	0	1	1	1	1	1	1 MHz
5	0	1	0	1	—	0	0	0	0	1	1	1	0 MHz
6	0	1	1	0	60	0	0	1	1	1	1	1	1 MHz
7	0	1	1	1	30	0	1	1	0	1	1	1	2 MHz
8	1	0	0	0	20	0	1	1	0	1	1	0	3 MHz
9	1	0	0	1	15	1	0	1	0	0	1	1	4 MHz

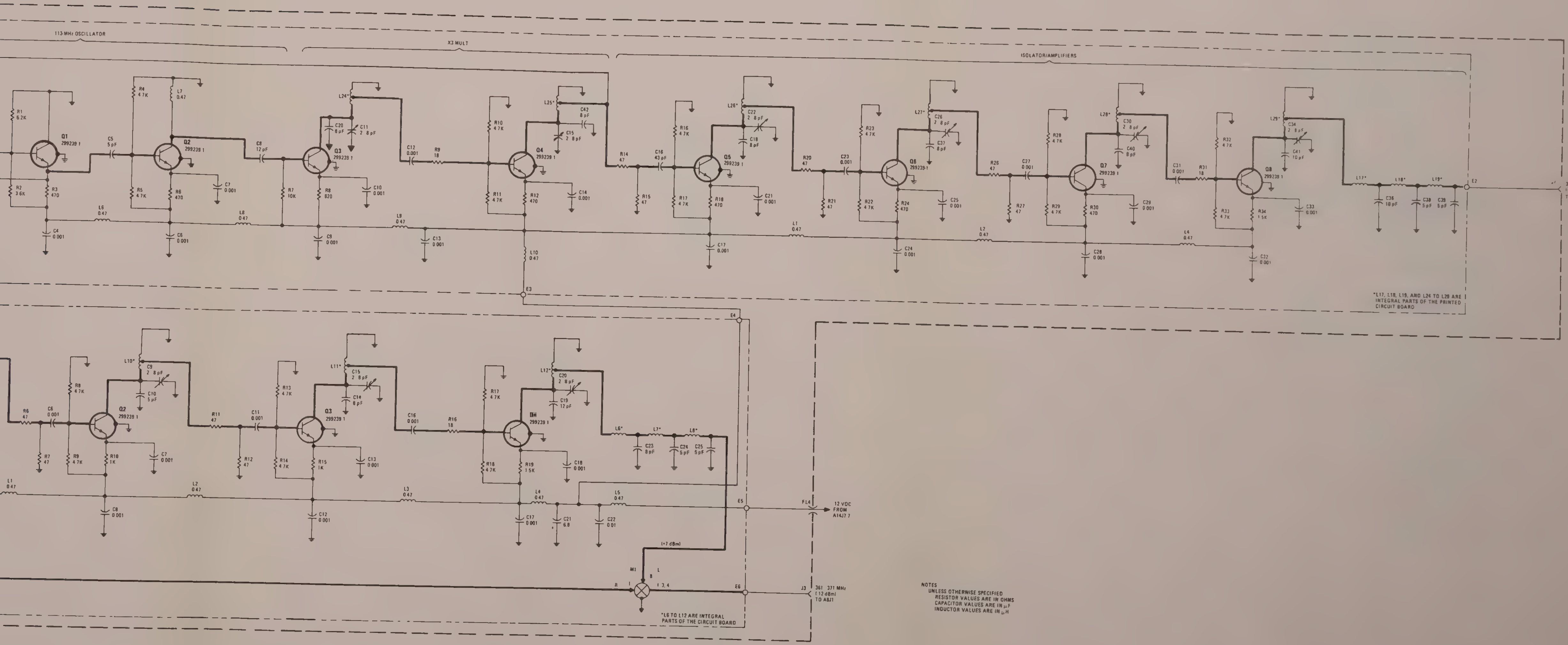
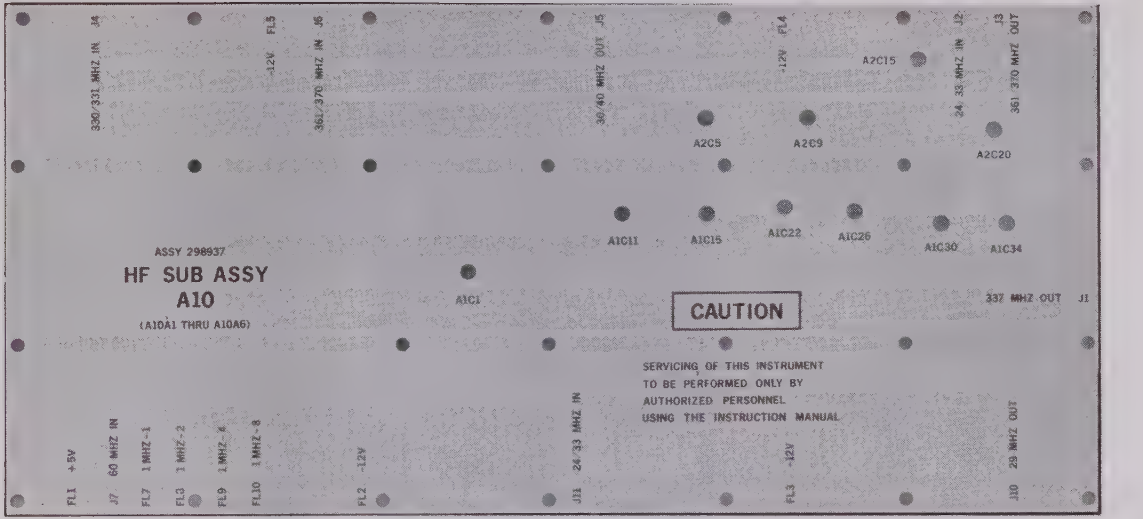
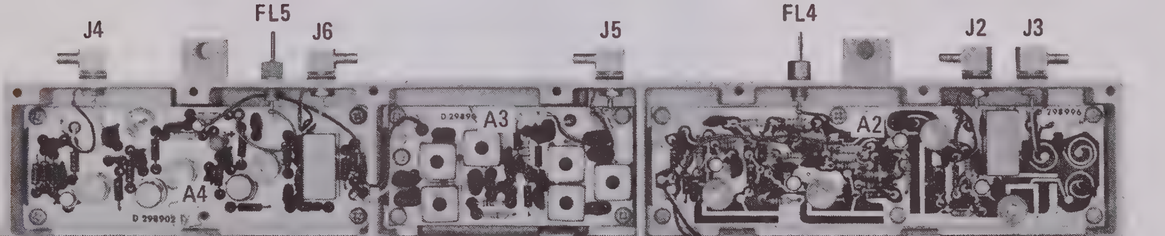

113-MHz OSCILLATOR
X3 MULT
ISOLATOR/AMPLIFIERS
Q1 299239 1
Q2 299239 1
Q3 299239 1
Q4 299239 1
Q5 299239 1
Q6 299239 1
Q7 299239 1
Q8 299239 1
E2
337 MHz (+7 dBm) TO A7J1
E3
E4
*L17, L18, L19, AND L24 TO L29 ARE INTEGRAL PARTS OF THE PRINTED CIRCUIT BOARD
(+7 dBm)
M1
R
I
L
B
1 3, 4
E5
FL4
12 VDC FROM A14J7 7
E6
J3
361 371 MHz (12 dBm) TO A8J1
*L6 TO L12 ARE INTEGRAL PARTS OF THE CIRCUIT BOARD
NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN µF
INDUCTOR VALUES ARE IN µH

Figure 6-93. 337 MHz Oscillator and Isolator Boards A10A1 and A10A2, Schematic Diagram


330/331 MHZ IN J4
-12V FL5
361/370 MHZ IN J6
30/40 MHZ OUT J5
-12V FL4
A2C15
24/33 MHZ IN J2
361/370 MHZ OUT J3
A2C5
A2C9
A2C20
A1C11
A1C15
A1C22
A1C26
A1C30
A1C34
ASSY 298937
HF SUB ASSY
A10
(A10A1 THRU A10A6)
A1C1
CAUTION
SERVICING OF THIS INSTRUMENT TO BE PERFORMED ONLY BY AUTHORIZED PERSONNEL USING THE INSTRUCTION MANUAL
337 MHZ OUT J1
FL1 +5V
J7 60 MHZ IN
FL7 1 MHZ-1
FL8 1 MHZ-2
FL9 1 MHZ-4
FL10 1 MHZ-8
FL2 -12V
J11 24/33 MHZ IN
FL3 -12V
J10 29 MHZ OUT


J4
FL5
J6
J5
FL4
J2
J3
A4
A3
A2
D 298902

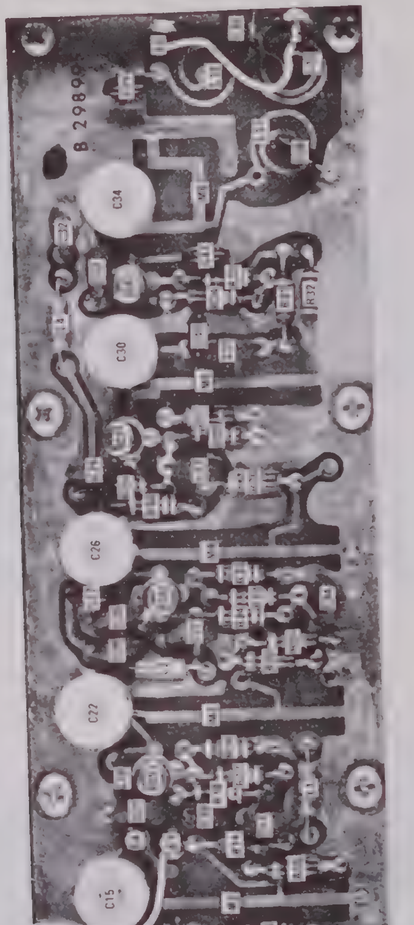
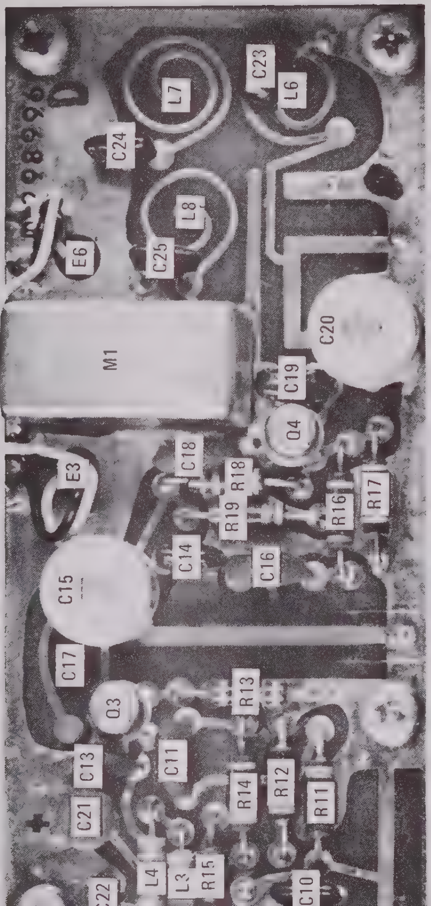


Figure 6-95. 337 MHz Oscillator Isolator Board A10A1, Component Locations



MHz Isolator Board A10A2, Component Locations

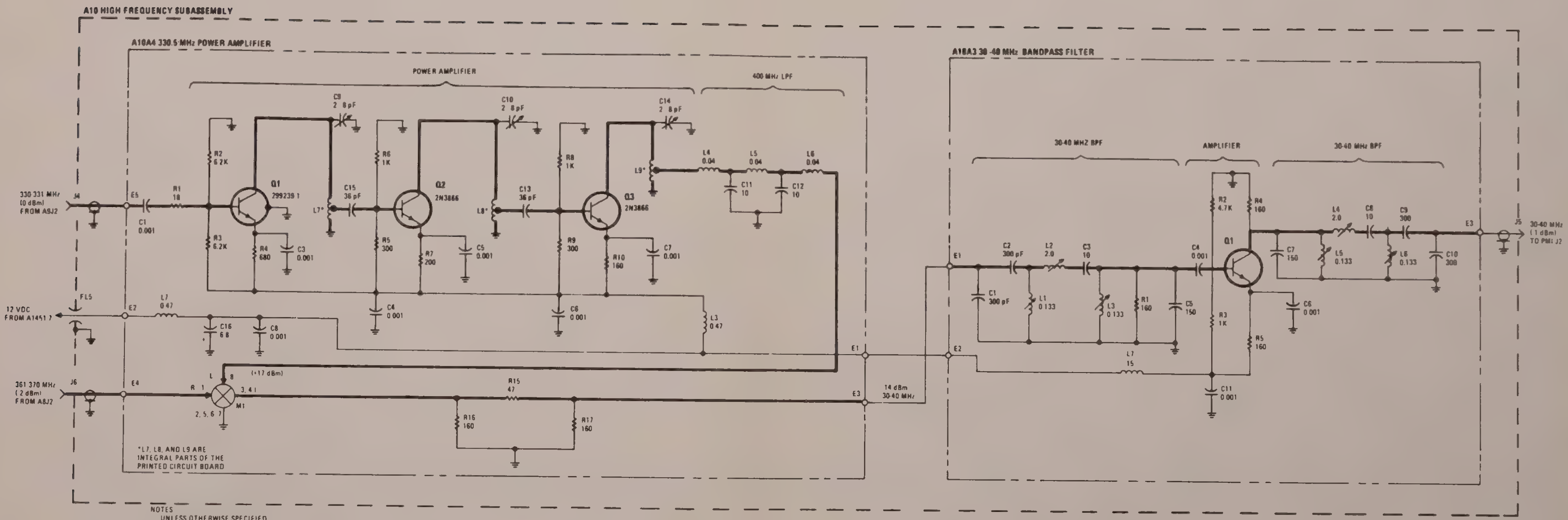
6-240. The programmable divider output appears at U1-11. This output is divided by an additional 2 or 4 by U3A, or U3A and U3B, respectively, as required for 1-, 2-, and 3-MHz outputs. The 60 MHz from the fixed frequency generator A5 is applied to driver Q1 which buffers the 60 MHz and drives U1. U1 in combination with U2 and U4 form the programmable divider.

6-241. U1 is a programmable binary counter which is set up to divide the 60-MHz input frequency by 10, 12, or 15 as determined by the BCD digit input control logic. U2 and U4 are used to detect the positive edge of the Q_D, U1 pin 11 of the counter and two counts later outputs a pulse to the parallel entry (PE) input of the counter which is synchronously programmed with the starting count. As indicated in the truth table, the counter output is the first stage of the divide sequence. Some input digits require an additional divide by 2 or 4 which is provided by U3. Each of these flip-flops is controlled by outputs from the control logic.

6-242. The output of the programmable divider appears at U3 pin 6 for 1 MHz, U3 pin 8 for 2 and 3 MHz, and U1 pin 11 for 4 and 5 MHz, depending on which frequency is programmed. The outputs are squarewaves and need filtering before the final output is useable. Transistors Q5, Q6, and Q7 form a single-pole, three-throw FET switch which selects the appropriate lowpass filter output. This output passes through a 3-dB attenuator formed by R22 through R24 and a final lowpass filter consisting of L14 and L15 and C32 through C34. Transistor Q8 is turned on only when the output is required to be a dc level. The output of the comb generator feeds the 29-MHz converter at a level of -8 dBm.

6-243. 29 MHz FILTER CONVERTER A10A6. (Figures 6-100 and 6-102). This board mixes the dc to 5-MHz output of A10A5 with the 24 to 33 MHz output of A6 producing 29 MHz. The 29 MHz is amplified and filtered to eliminate all signals 1 MHz and more away from 29 MHz.

6-244. The input from A10A5 at E1 passes through the lowpass filter formed by L30, L31, and C44. This reduces high frequency harmonics which may be present on the 1 to 5 MHz signal. This signal mixes with 24 to 33 MHz from A6 in M1. The 29-MHz sideband is selected by the two-pole bandpass filter formed by C1 through C4 and L1 through L3. The 29 MHz is amplified by Q1 which drives an eight pole bandpass filter consisting of C8, C10-C22, and L6-L15. The output of this filter is amplified by Q2 which drives another eight pole bandpass filter. This second eight pole filter is formed by C26, C28-C34, C36-C41, L17-L24, L26, and L27. The output of this board is at a level of -7 dBm and goes to the plug-in interface connector to drive the optional modulator. The output of the modulator, also 29 MHz, goes to the 366 MHz filter amplifier A7.



NOTES
UNLESS OTHERWISE SPECIFIED
RESISTOR VALUES ARE IN OHMS
CAPACITOR VALUES ARE IN μF
INDUCTOR VALUES ARE IN μH

Figure 6-97. 30-40 MHz Bandpass Filter A10A3 and 330.5 MHz Power Amplifier A10A4, Schematic Diagram

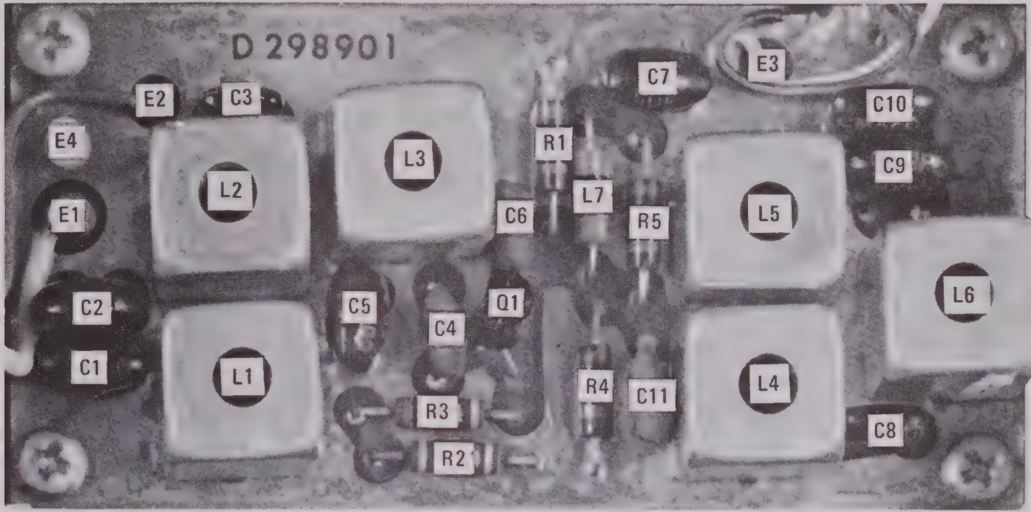
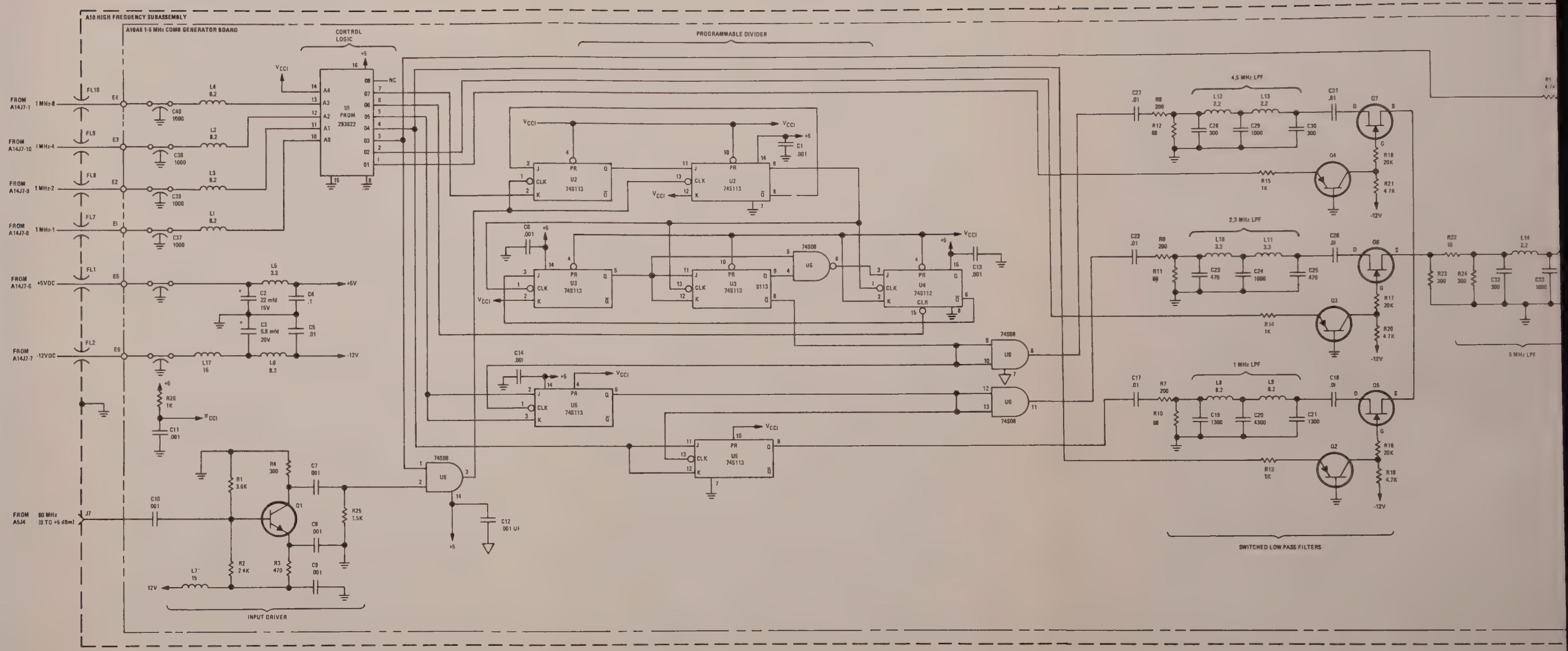
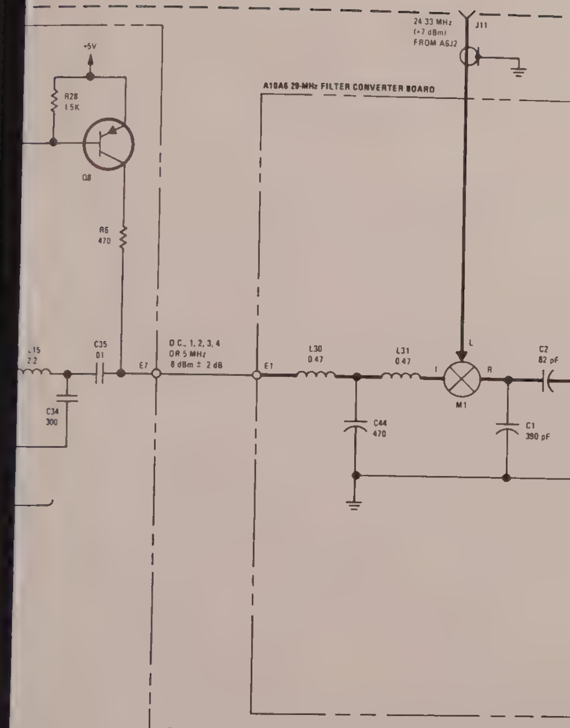
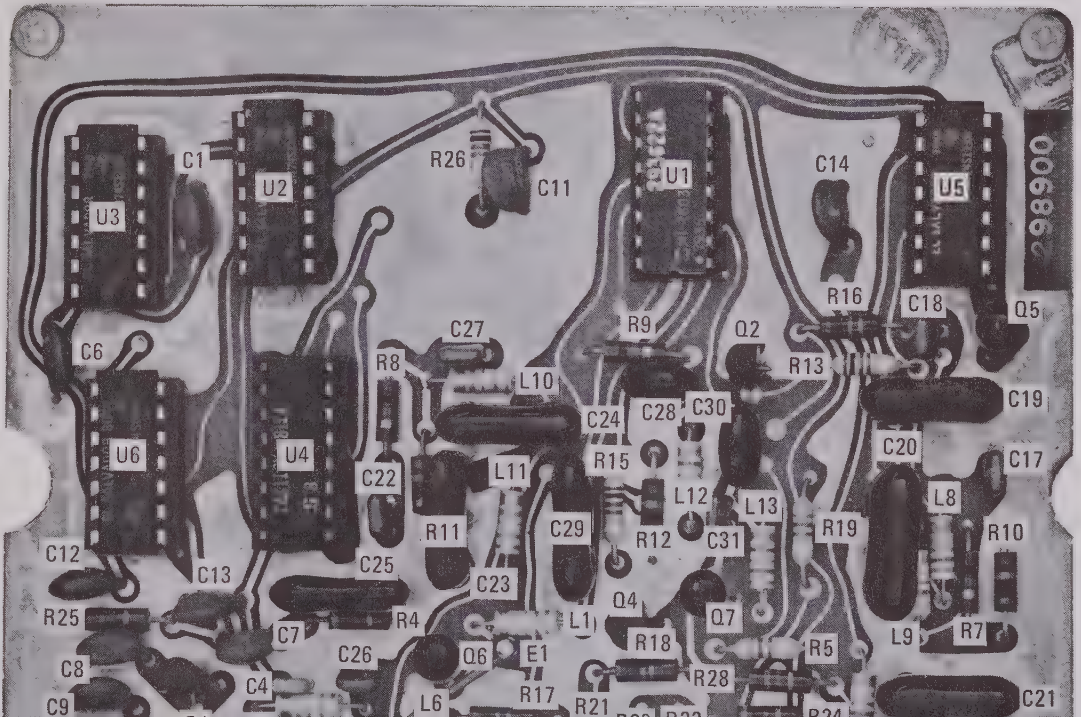


Figure 6-98. 30-40 MHz Bandpass Filter Board A10A3, Component Locations


A10 HIGH FREQUENCY SUBASSEMBLY
A10A5 1-5 MHz COMB GENERATOR BOARD
CONTROL LOGIC
PROGRAMMABLE DIVIDER
FROM A14J7-1 1 MHz-8
FROM A14J7-10 1 MHz-4
FROM A14J7-9 1 MHz-2
FROM A14J7-8 1 MHz-1
FROM A14J7-6 +5VDC
FROM A14J7-7 -12VDC
FROM A5J4 60 MHz (0 TO +5 dBm)
FL10
FL9
FL8
FL7
FL1
FL2
E4
E3
E2
E1
E5
E6
J7
C40 1000
C38 1000
C39 1000
C37 1000
L4 8.2
L2 8.2
L3 8.2
L1 8.2
L5 3.3
C2 22 mfd 15V
C4 .1
C3 6.8 mfd 20V
C5 .01
L17 15
L6 8.2
+5V
-12V
R26 1K
C11 .001
VCCI
U1 PROM 293622
A4
A3
A2
A1
A0
08
07
06
05
04
03
02
01
NC
U2 74S113
U3 74S113
U4 74S112
U5 74S113
U6 74S08
U6 74S113
J
K
CLK
PR
CLR
Q
C1 .001
C6 .001
C13 .001
C14 .001
C12 .001 UF
R4 300
C7 .001
R1 3.6K
Q1
R25 1.5K
C10 .001
C8 .001
R2 2.4K
R3 470
C9 .001
L7 15
12V
INPUT DRIVER
4.5 MHz LPF
C27 .01
R9 200
R12 68
L12 2.2
L13 2.2
C28 300
C29 1000
C30 300
C31 .01
Q7
D
S
G
R19 20K
R21 4.7K
Q4
R15 1K
2.3 MHz LPF
C22 .01
R8 200
R11 68
L10 3.3
L11 3.3
C23 470
C24 1000
C25 470
C26 .01
Q6
R17 20K
R20 4.7K
Q3
R14 1K
1 MHz LPF
C17 .01
R7 200
R10 68
L8 8.2
L9 8.2
C19 1300
C20 4300
C21 1300
C18 .01
Q5
R16 20K
R18 4.7K
Q2
R13 1K
R22 10
R23 300
R24 300
C32 300
L14 2.2
C33 1000
R5 4.7
5 MHz LPF
SWITCHED LOW PASS FILTERS



OUTPUT FREQ	- FCT.	BCD COMMAND				COUN		
		E4	E3	E2	E1	07	06	05
5 MHz	−12	0	0	0	0	1	0	0
4 MHz	−15	0	0	0	1	1	1	0
3 MHz	−20	0	0	1	0	0	1	1
2MHz	−30	0	0	1	1	1	1	1
1 MHz	−60	0	1	0	0	1	1	1
D C	-	0	1	0	1	1	1	1
1 MHz	−60	0	1	1	0	1	1	1
2 MHz	−30	0	1	1	1	1	1	1
3 MHz	−20	1	0	0	0	0	1	1
4 MHz	−15	1	0	0	1	1	1	0


C1
U3
U2
R26
C11
U1
C14
U5
298900
R16
C18
Q5
C27
R9
Q2
C6
R8
L10
R13
C19
C24
C28
C30
U6
U4
C22
R15
C20
C17
L11
L12
L13
L8
R11
C29
R12
C31
R19
R10
C12
C13
C25
C23
Q4
R25
R4
L1
Q7
L9
R7
C7
R18
R5
C8
C26
Q6
E1
R28
C4
R17
C21
C9
L6
R21
R24

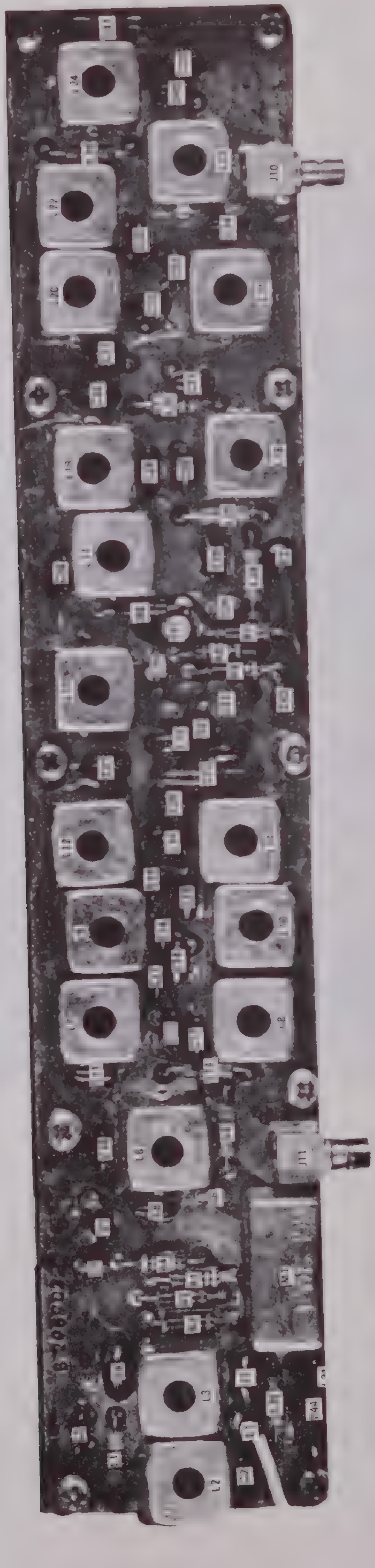


Figure 6-103. 30 MHz Filter Converter A10A6, Component Locations

CHAPTER 7

REPLACEABLE PARTS LIST

7-1. INTRODUCTION

7-2. This chapter contains the replaceable parts list for the AILTECH 380K11 Mainframe and 3600E1 Frequency Extender (Figure 7-1). This parts list is presented in reference designation order. The parts list contains the reference designation, AILTECH part number, quantity, description, manufacturers code, and manufacturers part number. Table 7-1 lists manufacturers by manufacturers code.

7-3. The mainframe parts (A1, A2, A4, A5, A11, A12, A14 and A15) are listed on pages 7-4 through 7-39. The frequency extender parts (A6-A10) are listed on pages 7-40 through 7-52.

E·T·N Advanced Electronics
380K SYNTHESIZED SIGNAL GENERATOR
E·T·N Advanced Electronics
MODE
PEAK DEVIATION
FULL SCALE
AM-%
FM-K/MHZ
ØM-DEG

TABLE 7-1. FEDERAL SUPPLY CODE MANUFACTURER (FSCM)

Vendor Code	Vendor Name	Vendor Address
00779	Amp Incorporated	PO Box 3608 Harrisburg, PA 17105
01121	Allen-Bradley Company	1201 South Second Street Milwaukee, WI 53204
01295	Texas Instruments Inc.,	PO Box 225012-MS-84 Dallas, TX 75265
02660	Bunker Ramo Corporation Amphenol Connector Division	2122 York Road Oak Brook, IL 60521
04713	Motorola Semi-Conductor Products	PO Box 20912 Phoenix, AZ 85036
05245	Corcom Inc.	1600 Winchester Road, Libertyville, IL 60048
05574	Viking Industries Inc.,	9324 Topanga Canyon Blvd., Chatsworth, CA 91311
07047	Milton Ross Company	210 Second Street, Pike, Southampton, PA 18966
09353	C&K Components Inc.	15 Riverdale Avenue Newton, MA 02158
1H847	Mepco/Electra Inc.	11468 Sorrento Valley Road San Diego, CA 92121
13409	Sensitron Semi-Conductor	221 West Industry Court, Deer Park, NY 11729
14655	Cornell-Dubilier Electronics	150 Avenue L, Newark, NJ 07105
15542	Mini-Circuits Lab.,	2625 East 14th Street, Brooklyn, NY 11235
18324	Signetics Corporation	811 East Arques Avenue, Sunnyvale, CA 94086
24355	Analog Devices, Inc.,	PO Box 280, Norwood, MA 02062
27014	National Semiconductor Corporation	2900 Semiconductor Drive, Santa Clara, CA 95051
21845	Solitron Devices, Inc.	1177 Blue Heron Road, Riviera Beach, FL 33404

TABLE 7-1. FEDERAL SUPPLY CODE MANUFACTURER (FSCM) (Cont)

Vendor Code	Vendor Name	Vendor Address
28480	Hewlett-Packard Corporation	1501 Page Mill Road Palo Alto, CA 94304
28875	IMC Magnetics Corporation,	Route 16B, Rochester, NH 03867
30992	Transtector Systems	Monterey Park, CA 91754
31433	Kemet, Union Carbide Corporation	PO Box 5928 Greenville, SC 29606
34050	Power Supplies Inc.	5 Brookside Drive PO Box 447, Middlefield, CT 06455
34649	Intel Memory Systems	1302 North Mathilda, Sunnyvale, CA 94086
41621	Power Supplies Inc.	5 Brookside Drive Middlefield, CT 06455
52763	Stettner-Trush Inc.,	67 Albany Street, Cazenovia, NY 13035
56289	Sprague Products Company	481 Marshall Street, North Adams, MA 01247

TABLE 7-1. FEDERAL SUPPLY CODE MANUFACTURER (FSCM) (Cont)

Vendor Code	Vendor Name	Vendor Address
72314	Fairchild Camera & Instrument Corporation	464 Ellis Street Mountain View, CA 94042
72982	Erie Technological Products	PO Box 961, Erie, PA 16512
75915	Littlefuse, Inc.,	800 East Northwest Highway, Des Plaines, IL 60016
80294	Bourns Inc.,	1200 Columbia Avenue, Riverside, CA 92507
81073	Grayhill Inc.,	569 Hillgrove Avenue, La Grange, IL 60525
91293	Johanson Mfg., Company,	Boonton, NJ 07005
91506	Augat Interconnection Products	33 Perry Avenue, Attleboro, MA 02703
91637	Dale Electronics Inc.,	PO Box 609 Columbus, NE 68601
91662	Elco Corporation	Huntingdon Industrial Park, Huntingdon, PA 16652
95275	Vitramon North America, Division Vitramon, Inc.,	PO Box 544, Bridgeport, CT 06601
98291	Sealectro Corporation	225 Hoyt Street, Mamaroneck, NY 10543
99800	American Precision Industries Inc.,	270 Quaker Road, East Aurora, NY 14052
99820	Disc Instruments Inc.,	102 East Baker Street Costa Mesa, CA 92626
*	PIHER Corporation	399 Washington Street Woburn, MA 01801

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
1	296433-003	1	380 K11 MAIN FRAME (FIGURE 6-6)	56872	296433-003
BR1	294772-001	2	RECTIFIER BRIDGE 25A	13409	S25A10
BR2	294772-001	2	RECTIFIER BRIDGE 25A	13409	S25A10
C1	299245-001	2	CAP:FXD CER .1UF –+20% 50WVDC	72982	8120-050-651-104M
C2	299245-001		CAP:FXD CER .1UF –+20% 50WVDC	72982	8120-050-651-104M
PS1	296428-001	1	ASSY POWER SUPPLY	41621	1223A
	296425-001	1	RECTIFIER HEATSINK	56872	296425-001
W1	299297-001	1	CABLE ASSY COAX	56872	299297-001
W2	299297-002	1	CABLE ASSY COAX	56872	299297-002
W3	299297-003	1	CABLE ASSY COAX	56872	299297-003
W4	299297-004	1	CABLE ASSY COAX	56872	299297-004
W5	299297-005	1	CABLE ASSY COAX	56872	299297-005
W6	299297-006	1	CABLE ASSY COAX	56872	299297-006
W7	299297-007	1	CABLE ASSY COAX	56872	299297-007
W8	299297-008	1	CABLE ASSY COAX	56872	299297-008
W9	299297-009	1	CABLE ASSY COAX	56872	299297-009
W10	299297-010	1	CABLE ASSY COAX	56872	299297-010
W12	299297-012	1	CABLE ASSY COAX	56872	299297-012
W14	299297-014	1	CABLE ASSY COAX	56872	299297-014
W18	299297-018	1	CABLE ASSY COAX	56872	299297-018
W23	299297-023	1	CABLE ASSY COAX	56872	299297-023
W24	299297-024	1	CABLE ASSY COAX	56872	299297-024
	296409-004	1	CABLE ASSY	56872	296409-004
	296409-001	1	CABLE ASSY	56872	296409-001
	296401-001	1	CABLE ASSY	56872	296401-001
	296403-001	1	CABLE ASSY	56872	296403-001
	296402-001	1	CABLE ASSY	56872	296402-001
	294948-001	1	LINE CORD	05245	80-1245
	231871-001	1	CABLE RIBBON, MAIN FRAME	56872	231871-001
A1	296389-001	1	ASSY, FRONT PANEL	56872	296389-001
C1	299245-001	1	CAP:FXD CER .1UF –+20% 50WVDC	72982	8121-050-651-104M
J1	294439-001	1	CONNECTOR, BNC	02660	74868UG-1094/U
S1	294531-001	1	SWITCH, 4 PDT	09353	C&K7401-J1-ZQE
W1	296409-003	1	ASSY, CABLE	56872	296409-003
					296306-001
A1A1	296306-001	1	PWB ASSY, KEYBOARD	56872	296306-001
C1	299240-002	1	CAP:FXD DIP TA 22 UF –+20% 15WVDC	31433	T368B226M015AS
C2	299245-001	16	CAP:FXD CER .1UF –+20% 50WVDC	72982	8120-050-651-104M
C3	299240-005	2	CAP:FXD DIP TA 68UF –+20% 15WVDC	31433	T362C686M015AS
C4	299240-005		CAP:FXD DIP TA 68UF –+20% 15WVDC	31433	T362C686M015AS

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A1A1CR9	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR10	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR11	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR12	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR13	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR14	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR15	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR16	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR17	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR18	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR19	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR20	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR21	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR22	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR23	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR24	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR25	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR26	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
CR27	296248-003		DIODE, LIGHT EMITTING	28480	HLMP-1301
J1	299934-006	1	HEADER:STRAIGHT 6 PIN	00779	87227-3
J5	299932-002	2	HEADER:STRAIGHT 28 PIN	00779	1-87227-4
J6	299932-002		HEADER:STRAIGHT 28 PIN	00779	1-87227-4
S1	293645-002	6	SWITCH:KEY	72092	DC61-05
S2	293645-002		SWITCH:KEY	72092	DC61-05
S3	293645-002		SWITCH:KEY	72092	DC61-05
S4	293645-002		SWITCH:KEY	72092	DC61-05
S5	293645-002		SWITCH:KEY	72092	DC61-05
S6	293645-002		SWITCH:KEY	72092	DC61-05
S7	293645-001	29	SWITCH:KEY	72092	DC61-03
S8	293645-001		SWITCH:KEY	72092	DC61-03
S9	293645-001		SWITCH:KEY	72092	DC61-03
S10	293645-001		SWITCH:KEY	72092	DC61-03
S11	293645-001		SWITCH:KEY	72092	DC61-03
S12	293645-001		SWITCH:KEY	72092	DC61-03
S13	293645-001		SWITCH:KEY	72092	DC61-03
S14	293645-001		SWITCH:KEY	72092	DC61-03
S15	293645-001		SWITCH:KEY	72092	DC61-03
S16	293645-001		SWITCH:KEY	72092	DC61-03
S17	293645-001		SWITCH:KEY	72092	DC61-03
S18	293645-001		SWITCH:KEY	72092	DC61-03
S19	293645-001		SWITCH:KEY	72092	DC61-03
S20	293645-001		SWITCH:KEY	72092	DC61-03
S21	293645-001		SWITCH:KEY	72092	DC61-03
S22	293645-001		SWITCH:KEY	72092	DC61-03
S23	293645-001		SWITCH:KEY	72092	DC61-03
S24	293645-001		SWITCH:KEY	72092	DC61-03
S25	293645-001		SWITCH:KEY	72092	DC61-03
S26	293645-001		SWITCH:KEY	72092	DC61-03
S27	293645-001		SWITCH:KEY	72092	DC61-03
S28	293645-001		SWITCH:KEY	72092	DC61-03
S29	293645-001		SWITCH:KEY	72092	DC61-03
S30	293645-001		SWITCH:KEY	72092	DC61-03
S31	293645-001		SWITCH:KEY	72092	DC61-03
S32	293645-001		SWITCH:KEY	72092	DC61-03
S33	293645-001		SWITCH:KEY	72092	DC61-03
S34	293645-001		SWITCH:KEY	72092	DC61-03
S35	293645-001		SWITCH:KEY	72092	DC61-03
U1	293212-003	11	INDICATOR:NUMERIC	28480	5082-7302
U2	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U3	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U4	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U5	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U6	293212-003		INDICATOR:NUMERIC	28480	5082-7302

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A1A1U7	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U8	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U9	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U10	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U11	293212-003		INDICATOR:NUMERIC	28480	5082-7302
U12	293541-019	4	IC:OCTAL LATCH	01295	SN74LS374N
U13	293691-008	2	IC:RESISTOR NETWORK	01121	316A331
U14	293691-008		IC:RESISTOR NETWORK	01121	316A331
U15	293541-019		IC:OCTAL LATCH	01295	SN74LS374N
U16	293541-019		IC:OCTAL LATCH	01295	SN74LS374N
U17	293541-019		IC:OCTAL LATCH	01295	SN74LS374N
XU1	296449-001	11	SOCKET:DISPLAY	91506	508-AG4F
XU2	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU3	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU4	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU5	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU6	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU7	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU8	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU9	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU10	296449-001		SOCKET:DISPLAY	91506	508-AG4F
XU11	296449-001		SOCKET:DISPLAY	91506	508-AG4F
A1A2	296308-001	1	PWB ASSY, ENCODER	56872	296308-001
C1	299240-005	1	CAP:FXD TA 68UF –+20% 15WVDC	31433	T362C686M015AS
C2	299245-001	15	CAP:FXD CER .1UF –+20% 50WVDC	72982	8121-050-651-104M
C3	299245-007	4	CAP:FXD CER 1.0UF –+20% 50WVDC	72982	8131-M058-651-105M
C4	299245-007		CAP:FXD CER 1.0UF –+20% 50WVDC	72982	8131-M058-651-105M
C5	299245-007		CAP:FXD CER 1.0UF –+20% 50WVDC	72982	8131-M058-651-105M
C6	299245-007		CAP:FXD CER 1.0UF –+20% 50WVDC	72982	8131-M058-651-105M
C7	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C8	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C9	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C10	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C11	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C12	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C13	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C14	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C15	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C16	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A1A2R8	299701-103		RESISTOR:FXD CAR 10K –+5% 1/4W	01121	RC07GF103J
R9	299701-512		RESISTOR:FXD CAR 5.1K –+5% 1/4W	01121	RC07GF512J
R10	299701-103		RESISTOR:FXD CAR 10K –+5% 1/4W	01121	RC07GF103J
R11	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R12	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
U1	293541-024	2	IC:3 TO 8 DECODER	01295	SN74LS138N
U2	293536-001	3	IC:DUAL D FLIP FLOP	01295	SN74LS74AN
U3	294038-001	2	IC:20 KEY ENCODER	01295	MM74C923N
U4	293541-024		IC:3 TO 8 DECODER	01295	SN74LS138N
U5	294038-001		IC:20 KEY ENCODER	01295	MM74C923N
U6	293540-001	1	IC:HEX INVERTER	01295	SN74LS04N
U7	293541-001	2	IC:QUAD NO. 2, IN NAND	01295	SN74LS00N
U8	293541-001		IC:QUAD NO. 2, IN NAND	01295	SN74LS00N
U9	294037-001	1	IC:OCTAL LATCH	01295	SN74S373N
U10	294036-001	1	IC:HEX 3 STATE BUFFER	01295	SN74LS365N
U11	294494-001	1	IC:HEX SCHMITT INVERTER	01295	SN74LS14N
U12	294045-001	1	IC:3 IN AND GATE	01295	SN74LS11N
U13	293536-001		IC:DUAL D FLIP FLOP	01295	SN74LS74AN
U14	293536-001		IC:DUAL D FLIP FLOP	01295	SN74LS74AN
A1A3	296424-001	1	ENCODER, OPTICAL	99820	PC66D-100-5
A2	298933-002	1	ASSY, LOWER ORDER BCD	56872	298933-002
W1	299277-001	1	PWB CABLE ASSEMBLY	56872	299227-001
A2A1	299204-001	1	PWB ASSY, FIXED TUNED BCD (1KHZ)	56872	299204-001
C1	299243-001	19	CAP:FXD CER DISC .001 UF –+20% 1000WVDC	56289	CK60AW102M
C2	299244-001	26	CAP:FXD CER DISC .01UF –+20+80% 1000WVDC	56289	5HKS-S10
C3	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C4	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C5	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C6	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C7	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C8	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C9	299241-200	6	CAP:FXD DIP MICA 20PF –+5% 300WVDC	72136	DM5-200J
C10	299241-101	1	CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C11	299241-200		CAP:FXD DIP MICA 20PF –+5% 300WVDC	72136	DM5-200J
C12	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C13	299241-430	4	CAP:FXD DIP MICA 43PF –+5% 300WVDC	72136	DM5-430J
C14	299241-430		CAP:FXD DIP MICA 43PF –+5% 300WVDC	72136	DM5-430J
C15	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C16	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C17	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C18	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C19	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C20	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C21	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C22	299241-100	6	CAP:FXD DIP MICA 10PF –+0.5PF 300WVDC	72136	DM5-100J
C23	299241-680	3	CAP:FXD DIP MICA 68PF –+0.5PF 300WVDC	72136	DM5-680J
C24	299241-100		CAP:FXD DIP MICA 10PF –+0.5PF 300WVDC	72136	DM5-100J
C25	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C26	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C27	299241-200		CAP:FXD DIP MICA 20PF –+5% 300WVDC	72136	DM5-200J
C28	299241-200		CAP:FXD DIP MICA 20PF –+5% 300WVDC	72136	DM5-200J
C29	299250-131	3	CAP:FXD DIP MICA 130PF –+5% 500WVDC	14655	CM04F131J03
C30	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C31	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C32	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C33	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C34	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A1 C35	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C36	299244-001		CAP:FXD CER DISC 0.1UF -20+80% 1000WVDC	56289	5HKS-S10
C37	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C38	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C39	299241-120	2	CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C40	299241-750	1	CAP:FXD DIP MICA 75PF -+5% 300WVDC	72136	DM5-750J
C41	299241-120		CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C42	294075-001	2	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C43	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C44	299250-241	3	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C45	299250-151	1	CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03
C46	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C47	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C48	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C49	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C50	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C51	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C52	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C53	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C54	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C55	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM-680J
C56	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C57	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C58	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C59	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C60	294075-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C61	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C62	299241-270	1	CAP:FXD DIP MICA 27PF -+5% 300WVDC	72136	DM5-270J
C63	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C64	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C65	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C66	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C67	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C68	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C69	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C70	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C71	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C72	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C73	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C74	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A1 L3	299237-038	11	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L4	299237-032	4	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L5	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L6	299237-022	4	INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L7	299237-022		INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L8	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L9	299237-028	2	INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L10	299237-028		INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L11	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L12	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L13	299237-024	6	INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L14	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L15	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L16	299237-026		INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L17	299237-020	2	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L19	299237-026		INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L20	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L21	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L22	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L23	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L24	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L25	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L26	299237-022		INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L27	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L28	299237-022		INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L29	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L30	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L31	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L32	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L33	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L34	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
Q1	294172-001	24	TRANSISTOR:NPN SI	04713	MPS918
Q2	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q3	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q4	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q5	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q6	294153-001	8	TRANSISTOR:PNP SI	04713	2N4126
Q7	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q8	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q9	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q10	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q11	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q12	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q13	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q14	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q15	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q16	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q17	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q18	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q19	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q20	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q21	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q22	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q23	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q24	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q25	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q26	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q27	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q28	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q29	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q30	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q31	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q32	294172-001		TRANSISTOR:NPN SI	04713	MPS918

INCLUDES 3D GLASSES

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A1 Q33	294151-001	3	TRANSISTOR:NPN SI	04713	2N4124
Q34	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q35	294151-001		TRANSISTOR:NPN SI	04713	2N4124
R1	299701-470	6	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R3	299701-102	12	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R4	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R5	299701-471	5	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R6	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R7	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R8	299701-472	4	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R9	299701-152	12	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R10	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R11	299701-103	4	RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R12	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R13	299701-681	6	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R14	299701-101	2	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R15	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R17	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R18	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R19	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R21	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R22	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R23	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R24	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R25	299701-103		RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R26	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R27	299701-622	5	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R28	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R29	299701-301	1	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R30	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R32	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R33	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R34	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R36	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R37	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R38	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R39	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R40	299701-103		RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R41	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R42	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A1 R67	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R68	299701-242		RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R69	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R70	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R71	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R72	299701-100	2	RESISTOR:FXD CAR 10 OHM -+5% 1/4W	01121	RC07GF100J
R73	299701-100		RESISTOR:FXD CAR 10 OHM -+5% 1/4W	01121	RC07GF100J
TP1	293199-001	1	TEST POINT	00779	2-582118-0
U1	293355-001	4	IC:LIN MIXER	01295	SN76514N
U2	293350-001	3	IC:TTL DUAL J-K FF	01295	SN74S113N
U3	293355-001		IC:LIN MIXER	01295	SN76514N
U4	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U5	293355-001		IC:LIN MIXER	01295	SN76514N
U6	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U7	293355-001		IC:LIN MIXER	01295	SN76514N
U8	296674-001	1	IC:TTL DECADE COUNTER	01295	SN74S196N
XU1-XU8	294573-001	8	SOCKET:IC 14 PIN	01295	C931410
A2A2	299214-001	3	PWB ASSY, BCD FIXED TUNED 0.1 TO 100 HZ	56872	299214-001
C1	299243-001	11	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C2	299244-001	26	CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C3	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C4	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C5	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C6	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C7	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C8	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C9	299241-200	6	CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C10	299241-101	1	CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
C11	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C12	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C13	299241-430	4	CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C14	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C15	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C16	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C17	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C18	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C19	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C20	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C21	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C22	299241-100	6	CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C23	299241-680	3	CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C24	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C25	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C26	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C27	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C28	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C29	299250-131	3	CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD141J03
C30	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C31	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C32	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C33	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C34	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C35	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C36	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C37	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C38	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C39	299241-120	2	CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C40	299241-750	1	CAP:FXD DIP MICA 75PF -5% 300WVDC	72136	DM5-750J
C41	299241-120		CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C42	294075-001	2	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C43	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C44	299250-241	3	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C45	299250-151	1	CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A2 C46	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C47	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C48	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C49	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C50	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C51	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C52	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C53	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C54	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C55	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C56	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C57	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C58	299241-680		CAP:FXD DIP MICA 68PF -+0.5% 300WVDC	72136	DM5-680J
C59	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C60	294075-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C61	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C62	299241-270	1	CAP:FXD DIP MICA 27PF -+5% 300WVDC	72136	DM5-270J
C63	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C64	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C65	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C66	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C75	299240-002	1	CAP:FXD DIP TA 22UF -+20% 15WVDC	31433	T368B226M015AS
C76	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C77	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C78	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	5HKS-S10
C79	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C80	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
CR1	299251-001	8	DIODE:SIGNAL	72314	IN4009
CR2	299251-001		DIODE:SIGNAL	72314	IN4009
CR3	299251-001		DIODE:SIGNAL	72314	IN4009
CR4	299251-001		DIODE:SIGNAL	72314	IN4009
CR5	299251-001		DIODE:SIGNAL	72314	IN4009
CR6	299251-001		DIODE:SIGNAL	72314	IN4009
CR7	299251-001		DIODE:SIGNAL	72314	IN4009
CR8	299251-001		DIODE:SIGNAL	72314	IN4009
E1	293310-001	4	TERMINAL SOLDER	71279	1597-2-01
L1	299237-026	4	INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L2	299237-026		INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L3	299237-038	9	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L4	299237-032	4	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A2 L29	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L30	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L33	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L34	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
Q1	294172-001	24	TRANSISTOR:NPN SI	04713	MPS918
Q2	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q3	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q4	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q5	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q6	294153-001	8	TRANSISTOR:PNP SI	04713	2N4126
Q7	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q8	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q9	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q10	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q11	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q12	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q13	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q14	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q15	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q16	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q17	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q18	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q19	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q20	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q21	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q22	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q23	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q24	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q25	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q26	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q27	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q28	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q29	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q30	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q31	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q32	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q35	294151-001	1	TRANSISTOR:NPN SI	04713	2N4124
R1	299701-470	6	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R3	299701-102	12	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R4	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R5	299701-471	5	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R6	299701-101	4	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R7	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R8	299701-472	4	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R9	299701-152	12	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R10	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R11	299701-103	4	RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R12	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R13	299701-681	6	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R14	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R15	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R17	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R18	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R19	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R21	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R22	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R23	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R24	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R25	299701-103		RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R26	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R27	299701-622	5	RESISTOR:FXD CAR 6.2K -+5% 1/4	01121	RC07GF622J
R28	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R29	299701-301	1	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R30	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R32	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R33	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A2 R34	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R36	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R37	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R38	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R39	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R40	299701-103		RESISTOR:FXD CAR 10K –+5% 1/4W	01121	RC07GF103J
R41	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R42	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R43	299701-681		RESISTOR:FXD CAR 680 OHM –+5% 1/4W	01121	RC07GF681J
R44	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R45	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R47	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R48	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R49	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R50	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R51	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R52	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R53	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R54	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R55	299701-103		RESISTOR:FXD CAR 10K –+5% 1/4W	01121	RC07GF103J
R56	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R57	299701-681		RESISTOR:FXD CAR 680 OHM –+5% 1/4W	01121	RC07GF681J
R58	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF822J
R59	299701-681		RESISTOR:CAR 600 OHM –+5% 1/4W	01121	RC07GF681J
R60	299701-681		RESISTOR:FXD CAR 680 OHM –+5% 1/4W	01121	RC07GF681J
R61	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R70	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R71	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R72	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R73	299701-470		RESISTOR:FXD CAR 47 OHM ±5% 1/4W	01121	RC07GF470J
TP1	293199-001	1	TEST POINT	00779	2-58118-0
U1	293355-001	4	IC:LIN MIXER	01295	SN76514N
U2	293350-001	3	IC:TTL DUAL J-K FF	01295	SN74S113N
U3	293355-001		IC:LIN MIXER	01295	SN76514N
U4	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U5	293355-001		IC:LIN MIXER	01295	SN76514N
U6	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U7	293355-001		IC:LIN MIXER	01295	SN76514N
U8	296674-001	1	IC:TTL DECADE COUNTER	01295	SN74S196N
XU1-XU8	294573-001	8	SOCKET:IC 14 PIN	01295	C931410

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A2A6 J9	294406-001		CONNECTOR:22 PIN DUAL EDGE	91662	00-6007-044-451-018
J10	294406-001		CONNECTOR:22 PIN DUAL EDGE	91662	00-6007-044-451-018
J11	299932-001		HEADER:DOUBLE ROW STRAIGHT POST 26 POS	00779	1-87227-3
A2A7	299220-001	2	PWB ASSY, BCD DISTRIBUTION BD	56872	299220-001
J1	299933-001	1	HEADER:RT ANGLE 26 PIN	00779	1-87230-3
A2A8	299220-001		SAME AS A2A7	56872	299220-001
A4	298934-001	1	ASSY, HIGHER ORDER BCD	56872	298934-001
FL1	293608-001	12	FILTER CONNECTOR	72982	1201-066
FL2	293608-001		FILTER CONNECTOR	72982	1201-066
FL3	293608-001		FILTER CONNECTOR	72982	1201-066
FL4	293608-001		FILTER CONNECTOR	72982	1201-066
FL5	293608-001		FILTER CONNECTOR	72982	1201-066
FL6	293608-001		FILTER CONNECTOR	72982	1201-066
FL7	293608-001		FILTER CONNECTOR	72982	1201-066
FL8	293608-001		FILTER CONNECTOR	72982	1201-066
FL9	293608-001		FILTER CONNECTOR	72982	1201-066
FL10	293608-001		FILTER CONNECTOR	72982	1201-066
FL11	293608-001		FILTER CONNECTOR	72982	1201-066
FL12	293608-001		FILTER CONNECTOR	72982	1201-066
A4A1	298904-001	1	PWB ASSY, BCD NO. 1	56872	298904-001
C1	299241-430	2	CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C2	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C3	299241-101	2	CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
C4	299250-241	2	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241-J03
C5	299241-101		CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
C6	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241-J03
C7	299245-002	6	CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C8	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C9	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C10	299250-391	2	CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C11	299250-181	2	CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
C12	299250-131	2	CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C13	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C14	299250-181		CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04F0181J03
C15	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C16	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C17	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C18	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
E1	293310-001	4	TERMINAL SOLDER	71279	1597-2-01
E2	293306-001	2	TERMINAL:DISCONNECT	71279	1019-2-901
E3	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293310-001		TERMINAL SOLDER	71279	1597-2-01
E6	293310-001		TERMINAL SOLDER	71279	1597-2-01
J1	299235-001	1	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-008	1	INDUCTOR:FXD MOLDED .33UH	99800	1025-08
L2	231105-003	2	INDUCTOR:VAR .44UH	56872	231105-003
L3	299237-032	2	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L4	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L5	299237-048	2	INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L6	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L7	231105-004	4	INDUCTOR:VAR .9UH	56872	231105-004
L8	299237-038	2	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L9	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L10	299237-044	1	INDUCTOR:FXD MOLDED 10.0 UH	99800	1025-044
L11	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L12	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L13	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L14	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A1 M1	231104-001	1	MIXER	15542	SRA-1
Q1	294172-001	1	TRANSISTOR:NPN SI	04713	MP5918
R1	299701-301	4	RESISTOR, 300 OHM 1/4W, 5%	01121	RC07GF301J
R2	299701-180	2	RESISTOR, 18 OHM 1/4W, 5%	01121	RC07GF180J
R3	299701-301		RESISTOR, 300 OHM, 1/4W, 5%	01121	RC07GF301J
R4	299701-301		RESISTOR, 300 OHM, 1/4W, 5%	01121	RC07GF301J
R5	299701-180		RESISTOR, 18 OHM, 1/4W, 5%	01121	RC07GF180J
R6	299701-301		RESISTOR, 300 OHM, 1/4W, 5%	01121	RC07GF301J
R7	299701-362	1	RESISTOR, 3.6K, 1/4W, 5%	01121	RC07GF362J
R8	299701-242	1	RESISTOR, 2.4K, 1/4W, 5%	01121	RC07GF242J
R9	299701-391	2	RESISTOR, 390 OHM, 1/4W, 5%	01121	RC07GF391J
R10	299701-391		RESISTOR, 390 OHM, 1/4W, 5%	01121	RC07GF391J
R11	299701-471	1	RESISTOR, 470 OHM, 1/4W, 5%	01121	RC07GF471J
R12	299701-101	1	RESISTOR, 100 OHM, 1/4W, 5%	01121	RC07GF101J
U1	293350-001	1	IC:TTL DUAL J-K FF	01295	SN74S113N
XU1	294573-001	1	SOCKET, 14 PIN	01295	C931410
A4A2	298905-001	1	PWB ASSY, BCD 2	56872	298905-001
C1	299241-101	6	CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C2	299250-301	3	CAP:FXD DIP MICA 300PF –+5% 300WVDC	14655	CM04FC301J03
C3	299241-101		CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C4	299250-241	2	CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C5	299241-101		CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C6	299241-101		CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C7	299250-241		CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C8	299245-002	6	CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C9	299245-002		CAP:FXD CER .01UF ±20% 50WVDC	72982	8121-M058-651-103M
C10	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C11	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C12	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C13	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C14	299250-151	2	CAP:FXD DIP MICA 150PF –+5% 500WVDC	14655	CM04FD151J03
C15	299250-301		CAP:FXD DIP MICA 300PF –+5% 300WVDC	14655	CM04FC301J03
C16	299241-101		CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C17	299241-101		CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C18	299250-151		CAP:FXD DIP MICA 150PF –+5% 500WVDC	14655	CM04FD151J03
C19	299250-301		CAP:FXD DIP MICA 300PF –+5% 300WVDC	14655	CM04FC301J03
E1	293305-001	3	TERMINAL:DISCONNECT	71279	1019-2-901

Reference Designation		AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A2	L14	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
	L15	299237-042		INDUCTOR:FXD MOLDED 8.2UH	99800	1025-042
	M1	231104-001	1	MIXER	15542	SRA-1
	Q1	294172-001	1	TRANSISTOR:NPN SI	04713	MPS918
	R1	299701-161	2	RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
	R2	299701-470	1	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
	R3	299701-161		RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
	R4	299701-301	2	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
	R5	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
	R6	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
	R7	299701-362	1	RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
	R8	299701-242	1	RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
	R9	299701-391	2	RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
	R10	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
	R11	299701-471	1	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
	R12	299701-101	1	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
	U1	293350-001	1	IC:TTL DUAL J-K FF	01295	SN74S113N
	XU1	294573-001	1	SOCKET:IC 14 PIN	01295	C931410
A4A3		298906-001	1	PWB ASSY, BCD NO. 4	56872	298906-001
	C1	299241-680	2	CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
	C2	299250-241	1	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
	C3	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
	C4	299250-181	4	CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
	C5	299241-101	2	CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
	C6	299241-750	1	CAP:FXD DIP MICA 75PF -+5% 300WVDC	72136	DM5-750J
	C7	299241-101		CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
	C8	299250-181		CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
	C9	299245-002	6	CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C10	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C11	299245-002		CAP:FXD.CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C12	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C13	299241-100	1	CAP:FXD CER MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
	C14	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C15	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C16	299250-301	2	CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
	C17	299250-391	2	CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
	C18	299250-181		CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
	C19	299250-181		CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
	C20	299250301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
	C21	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
	E1	293306-001	4	TERMINAL:DISCONNECT	71279	1019-2-901
	E2	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
	E3	293310-001	4	TERMINAL SOLDER	71279	1597-2-01
	E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
	E5	293310-001		TERMINAL SOLDER	71279	1597-2-01
	E6	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
	E7	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
	E8	293310-001		TERMINAL SOLDER	71279	1597-2-01
	L1	299237-012	2	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
	L2	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
	L3	231105-002	3	INDUCTOR:VAR .27UH	56872	231105-002
	L4	299237-032	4	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
	L5	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
	L6	231105-002		INDUCTOR:VAR .27UH	56872	231105-002
	L7	231105-002		INDUCTOR:VAR .27UH	56872	231105-002
	L8	299237-048	2	INDUCTOR:FXD MOLDED 15UH	99800	1025-048
	L9	299237-020	1	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
	L10	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
	L11	231105-003	4	INDUCTOR:VAR .44UH	56872	231105-003
	L12	299237-032	4	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032

Reference Designation		AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A3	L13	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
	L14	299237-038	1	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
	L15	231105-003		INDUCTOR:FXD .44UH	56872	231105-003
	L16	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
	L17	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
	M1	231104-001	1	MIXER	15542	SRA-1
	Q1	294172-001	1	TRANSISTOR:NPN SI	04713	MPS918
	R1	299701-101	3	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
	R2	299701-470	1	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
	R3	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
	R4	299701-301	2	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
	R5	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
	R6	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
	R7	299701-362	1	RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
	R8	299701-242	1	RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
	R9	299701-391	2	RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
	R10	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
	R11	299701-471	1	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
	R12	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
	U1	293350-001	1	IC:TTL DUAL J-K FF	01295	SN74S113N
	XU1	294573-001	1	SOCKET, 14 PIN	01295	C932410
A4A4		298907-001	1	PWB ASSY, BCD 8 NO. 1	56872	298907-001
	C1	249241-101	2	CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
	C2	299241-101		CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
	C3	299241-680	2	CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
	C4	299250-181	2	CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
	C5	299241-470	2	CAP:FXD DIP MICA 47PF -+5% 300WVDC	72136	DM5-470J
	C6	299241-470		CAP:FXD DIP MICA 47PF -+5% 300WVDC	72136	DM5-470J
	C7	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
	C8	299280-181		CAP:FXD DIP MICA 180PF -+5% 500WVDC	14655	CM04FD181J03
	C9	299245-002	4	CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C10	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C11	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	C12	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
	E1	293310-001	7	TERMINAL SOLDER	71279	1597-2-01
	E2	293310-001		TERMINAL SOLDER	71279	1597-2-01

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A4 R10	299701-391		RESISTOR:FXD CAR 350 OHM –+5% 1/4W	01121	RC07GF391J
A4A5	298908-001	1	PWB ASSY, BCD 8 NO. 2	56872	298908-001
C1	299250-181	2	CAP:FXD DIP MICA 180PF –+5% 500WVDC	14655	CM04FD181J03
C2	299241-680	2	CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C3	299241-680		CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C4	299250-181		CAP:FXD DIP MICA 180PF ±5% 500WVDC	14655	CM04FD181J03
C5	299245-002	12	CAP:FXD CER .01UH –+20% 50WVDC	72982	8121-M058-651-103M
C6	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C7	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C8	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C9	299245-001	4	CAP:FXD CER .1UF –+20% 50WVDC	72982	8121-M058-W5R0-104M
C10	299245-001		CAP:FXD CER .1UF –+20% 50WVDC	72982	8121-M058-W5R0-104M
C11	299240-002	1	CAP:FXD DIP TA 22UF –+20% 15WVDC		T268B226M015AS
C12	299245-001		CAP:FXD CER .1UF –+20% 50WVDC	72982	8121-M058-W5R0-104M
C13	299250-471	2	CAP:FXD DIP MICA 470PF –+5% 500WVDC	14655	CM06FD471J03
C14	299250-132	2	CAP:FXD DIP MICA 1300PF –+5% 500WVDC	14655	CM06FD132J03
C15	299250-331	3	CAP:FXD DIP MICA 330PF –+5% 100WVDC	14655	CM04FA331J03
C16	299241-070	2	CAP:FXD DIP MICA 7PF –+0.5PF 300WVDC	72136	DM5-070D
C17	299250-331		CAP:FXD DIP MICA 330PF –+0.5PF 100WVDC	72136	CM04FA331J03
C18	299250-331		CAP:FXD DIP MICA 330PF –+0.5PF 100WVDC	72136	CM04FA331J03
C19	299241-070		CAP:FXD DIP MICA 7PF –+0.5PF 300WVDC	72136	DM5-070D
C20	299250-471		CAP:FXD DIP MICA 470PF –+5% 500WVDC	14655	CM06FD471J03
C21	299250-132		CAP:FXD DIP MICA 1300PF –+5% 500WVDC	14655	CM06FD132J03
C22	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C23	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C24	299250-241	3	CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C25	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C26	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C27	299250-241		CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C28	299250-391	2	CAP:FXD DIP MICA 390PF –+5% 100WVDC	14655	CM04FA391J03
C29	299250-151	1	CAP:FXD DIP MICA 150PF –+5% 500WVDC	14655	CM04FD151J03
C30	299250-241		CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C31	299250-391		CAP:FXD DIP MICA 390PF –+5% 100WVDC	14655	CM04FA391J03
C32	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C33	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C34	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C35	299241-430	2	CAP:FXD DIP MICA 43PF –+5% 300WVDC	72136	DM5-430J
C36	299241-430		CAP:FXD DIP MICA 43PF –+5% 300WVDC	72136	DM5-430J
C37	299240-001	1	CAP:FXD DIP TA 6.8UF –+20% 35WVDC	31433	T368B685M035AS
C38	299245-001		CAP:FXD CER .1UF –+20% 50WVDC	72982	8121-M058-W5R0-104M
C39	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
E1	293310-001	2	TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
J1	299235-001	1	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	231105-002	2	INDUCTOR:VAR .27UH	56872	231105-002
L2	231105-002		INDUCTOR:VAR .27UH	56872	231105-002
L3	299237-038	3	INDUCTOR:FXD MOLDED 5.6UH	56872	1025-038
L4	299237-048	7	INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L5	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L6	299237-032	3	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L7	231105-004	5	INDUCTOR:VAR .9UH	56872	231105-004
L8	299237-056	2	INDUCTOR:FXD MOLDED 33UH	99800	1025-046
L9	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L10	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L11	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L12	299237-056		INDUCTOR:FXD MOLDED 33UH	99800	1025-056

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A5 L13	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L14	299237-048		INDUCTOR:VAR MOLDED 15UH	99800	1025-048
L15	231105-001	3	INDUCTOR:VAR .133UH	56872	231105-001
L16	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L17	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L18	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L19	299237-008	1	INDUCTOR:FXD MOLDED .33UH	99800	1025-08
L20	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L21	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L22	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L23	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L24	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L25	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L26	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
Q1	294172-001	2	TRANSISTOR:NPN SI	04713	MPS918
Q2	294156-001	1	TRANSISTOR:PNP SI	04713	2N4403
Q3	299239-001	2	TRANSISTOR:NPN SI	04713	2N5179
Q4	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q5	294172-001		TRANSISTOR:NPN SI	04713	MPS918
R1	299701-362	3	RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R2	299701-242	3	RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R3	299701-391	4	RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R4	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R5	299701-681	1	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R6	299701-102	2	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R7	299701-101	3	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R8	299701-301	1	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R9	299701-362		RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R10	299701-242		RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R11	299701-471	1	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R12	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R13	299701-622	1	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R14	299701-152	1	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R15	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R16	299701-201	1	RESISTOR:FXD CAR 200 OHM -+5% 1/4W	01121	RC07GF201J
R17	299701-362		RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R18	299701-242		RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R19	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R20	299701-101	2	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A6 E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293306-001	1	TERMINAL:DISCONNECT	71279	1019-2-901
J2	299235-001	4	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J3	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J4	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J5	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-038	5	INDUCTOR:FXD MOLDED 5.6UH	98900	1025-038
L2	299237-038		INDUCTOR:FXD MOLDED 5.6UH	98900	1025-038
L3	231105-001	4	INDUCTOR:VAR .133UH	56872	231105-001
L4	299237-034	2	INDUCTOR:FXD MOLDED 3.9UH	98900	1025-034
L5	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L6	299237-036		INDUCTOR:FXD MOLDED 5.6UH	98900	1025-038
L7	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L8	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L9	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L10	299237-034		INDUCTOR:FXD MOLDED 3.9UH	99800	1025-034
L11	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
Q1	299239-001	2	TRANSISTOR:NPN SI	04713	2N5179
Q2	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R1	299701-010	6	RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R3	299701-362	2	RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R4	299701-242	2	RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R5	299701-102	2	RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R6	299701-471	2	RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R7	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R8	299701-180	2	RESISTOR:FXD CAR 18 OHM –+5% 1/4W	01121	RC07GF180J
R9	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R10	299701-242		RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R11	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R12	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R14	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R15	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R16	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R17	299701-180		RESISTOR:FXD CAR 18 OHM –+5% 1/4W	01121	RC07GF180J
R18	299701-101		RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
A4A7	298910-001	4	PWB ASSY, 64/65 MHZ SWITCH	56872	298910-001
C1	299245-002	5	CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C2	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C4	299245-001	2	CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C5	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C7	299871-391	1	CAP:FXD CER 290PF –+10% 200WVDC	56289	CK05BX391K
C8	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C9	299245-002		CAP FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C10	299245-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C11	299241-101	1	CAP:FXD DIP MICA 100PF –+5% 300WVDC	72136	DM5-101J
C12	299241-750	1	CAP:FXD DIP MICA 75PF –+5% 300WVDC	72136	DM5-750J
C13	299241-560	1	CAP:FXD DIP MICA 56PF –+5% 300WVDC	72136	DM5-560J
C14	299250-241	1	CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
CR1	299251-001	2	DIODE:SIGNAL	72314	IN4009
CR2	299251-001		DIODE:SIGNAL	72314	IN4009
E1	293306-001	8	TERMINAL:DISCONNECT	71279	1019-2-901
E2	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E4	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E5	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E6	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E7	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E8	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E9	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
L1	299237-038	4	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L2	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L3	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L4	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L5	231105-001	2	INDUCTOR:VAR .133UH	56872	231105-001

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A7 L6	299237-032	1	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L7	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
Q1	294172-001	5	TRANSISTOR:NPN SI	04713	MPS918
Q2	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q3	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q4	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q5	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q7	294153-001	2	TRANSISTOR:PNP SI	04713	2N4126
Q8	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q9	299239-001	1	TRANSISTOR:NPN SI	04713	2N5179
R1	299701-101	4	RESISTOR:FXD CAR 100 OHM −+5% 1/4W	01121	RC07GF101J
R2	299701-101		RESISTOR:FXD CAR 100 OHM −+5% 1/4W	01121	RC07GF101J
R3	299701-102	4	RESISTOR:FXD CAR 1K −+5% 1/4W	01121	RC07GF102J
R4	299701-681	2	RESISTOR:FXD CAR 680 OHM −+5% 1/4W	01121	RC07GF681J
R5	299701-102		RESISTOR:FXD CAR 1K −+5% 1/4W	01121	RC07GF102J
R6	299701-101		RESISTOR:FXD CAR 100 OHM −+5% 1/4W	01121	RC07GF101J
R7	299701-101		RESISTOR:FXD CAR 100 OHM −+5% 1/4W	01121	RC07GF101J
R8	299701-102		RESISTOR:FXD CAR 1K −+5% 1/4W	01121	RC07GF102J
R9	299701-152	3	RESISTOR:FXD CAR 1.5K −+5% 1/4W	01121	RC07GF152J
R10	299701-472	1	RESISTOR:FXD CAR 4.7K −+5% 1/4W	01121	RC07GF472J
R12	299701-152		RESISTOR:FXD CAR 1.5K −+5% 1/4W	01121	RC07GF152J
R13	299701-103	1	RESISTOR:FXD CAR 10K −+5% 1/4W	01121	RC07GF103J
R14	299701-152		RESISTOR:FXD CAR 1.5K −+5% 1/4W	01121	RC07GF152J
R15	299701-242	1	RESISTOR:FXD CAR 2.4K −+5% 1/4W	01121	RC07GF242J
R16	299701-362	1	RESISTOR:FXD CAR 3.6K −+5% 1/4W	01121	RC07GF362J
R17	299701-102		RESISTOR:FXD CAR 1K −+5% 1/4W	01121	RC07GF102J
R18	299701-681		RESISTOR:FXD CAR 680 OHM −+5% 1/4W	01121	RC07GF681J
A4A8	298910-001		SAME AS A4A7	56872	298910-001
A4A9	298910-001		SAME AS A4A7	56872	298910-001
A4A10	298910-001		SAME AS A4A7	56872	298910-001
A4A11	299248-001	1	PWB ASSY, BCD FIXED TUNED 10 KHZ	56872	299248-001
C1	299243-001	35	CAP:FXD CER DISC .001UF −+20% 1000WVDC	56289	CK60AW102M
C2	299243-001		CAP:FXD CER DISC..001UF −+20% 1000WVDC	56289	CK60AW102M
C3	299241-060	4	CAP:FXD DIP MICA 6PF −+0.5PF 300WVDC	72136	DM5-0600
C4	299241-200	6	CAP:FXD DIP MICA 20PF −+5% 300WVDC	72136	DM5-200J
C5	299241-101	1	CAP:FXD DIP MICA 100PF −+5% 300WVDC	72136	DM5-101J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A11C28	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C29	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C30	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C31	299241-060		CAP:FXD DIP MICA 6PF -+0.5PF 300WVDC	72136	DM5-0600
C32	299241-120	2	CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C33	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C34	299241-750	1	CAP:FXD DIP MICA 75PF -+5% 300WVDC	72136	DM5-750J
C35	299241-120		CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C36	299245-001	2	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-M058-W5R0-104M
C37	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C38	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C39	299250-151	1	CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03
C40	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C41	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C42	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C43	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C44	299241-060		CAP:FXD DIP MICA 6PF -+0.5 300WVDC	72136	DM5-0600
C45	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C46	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C47	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C48	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C49	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C50	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C51	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-M058-W5R0-104M
C52	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C53	299241-270	1	CAP:FXD DIP MICA 27PF -+5% 300WVDC	72136	DM5-270J
C54	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C55	299241-200		CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C56	299250-131		CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C57	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C58	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C59	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C60	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C61	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C62	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C63	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C64	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C65	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C66	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C67	299241-070	4	CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C68	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C69	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C70	299241-070		CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C71	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C72	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C73	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C74	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C75	299241-070		CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C76	299240-002	1	CAP:FXD DIP TA 22UF -+20% 15WVDC	31433	T368B226M015AS
C77	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C78	299241-070		CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C79	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C80	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C81	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C82	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C83	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C84	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C85	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
CR1	299251-001	8	DIODE:SIGNAL	72314	IN4009
CR2	299251-001		DIODE:SIGNAL	72314	IN4009
CR3	299251-001		DIODE:SIGNAL	72314	IN4009

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A11 CR4	299251-001		DIODE:SIGNAL	72314	IN4009
CR5	299251-001		DIODE:SIGNAL	72314	IN4009
CR6	299251-001		DIODE:SIGNAL	72314	IN4009
CR7	299251-001		DIODE:SIGNAL	72314	IN4009
CR8	299251-001		DIODE:SIGNAL	72314	IN4009
E1	293306-001	6	TERMINAL:DISCONNECT	71279	1019-2-901
E2	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E3	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E4	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E5	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E6	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
J7	299235-001	6	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J8	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J9	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J10	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J11	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J12	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-020	10	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L2	299237-038	18	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L3	299237-026	4	INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L4	299237-026		INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L5	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L6	299237-032	4	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L7	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L8	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L9	299237-036		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L10	299237-022	4	INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L11	299237-022		INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L12	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L13	299237-028	2	INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L14	299237-028		INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L15	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L16	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L17	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L18	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L19	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L20	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L21	299237-024	6	INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L22	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L23	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A11 L48	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
M1	231104-001	4	MIXER	15542	SRA-1
M2	231104-001		MIXER	15542	SRA-1
M3	231104-001		MIXER	15542	SRA-1
M4	231104-001		MIXER	15542	SRA-1
Q1	299239-001	4	TRANSISTOR:NPN SI	04713	2N5179
Q2	294151-001	7	TRANSISTOR:NPN SI	04713	2N4124
Q3	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q4	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q5	294172-001	20	TRANSISTOR:NPN SI	04713	MPS918
Q6	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q7	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q8	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q9	294153-001	8	TRANSISTOR:PNP SI	04713	2N4126
Q10	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q11	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q12	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q13	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q14	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q15	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q16	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q17	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q18	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q19	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q20	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q21	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q22	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q23	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q24	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q25	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q26	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q27	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q28	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q29	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q30	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q31	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q32	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q33	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q34	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q35	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q36	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q37	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q38	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q39	294151-001		TRANSISTOR:NPN SI	04713	2N4124
R1	299701-622	15	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R2	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R3	299701-301	4	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301
R4	299701-471	4	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R5	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R6	299701-681	6	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R7	299701-101	17	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R8	299701-470	3	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R9	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R10	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R11	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R12	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R13	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R14	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R15	299701-680	1	RESISTOR:FXD CAR 68 OHM -+5% 1/4W	01121	RC07GF680J
R16	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R17	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R18	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R19	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R20	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A11 R21	299701-472	6	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R22	299701-152	14	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R23	299701-102	18	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R24	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R25	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R26	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R27	299701-103	4	RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R28	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R29	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R30	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R31	299701-101		RESISTOR:FXD CAR 100 OHM ±5% 1/4W	01121	RC07GF101J
R32	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R33	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R34	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R35	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R36	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R37	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R38	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R39	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R40	299701-103		RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R41	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R42	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R43	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R44	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R45	299701-301	1	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R46	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R47	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R48	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R49	299701-161	1	RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
R50	299701-470		RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R51	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R52	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R53	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R54	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R55	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R56	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R57	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R58	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R59	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R60	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A4A11 R86	299701-100	3	RESISTOR:FXD CAR 10 OHM -+5% 1/4W	01121	RC07GF100J
R87	299701-100		RESISTOR:FXD CAR 10 OHM -+5% 1/4W	01121	RC07GF100J
R88	299701-100		RESISTOR:FXD CAR 10 OHM -+5% 1/4W	01121	RC07GF100J
R89	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R90	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R91	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R92	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R93	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R94	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R95	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R96	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
U1	293350-001	3	IC:TTL DUAL J-K FF	01295	SN74S113N
U2	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U3	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U4	296674-001	1	IC:TTL DECADE COUNTER	18324	SN74S196N
	294573-001	4	SOCKET:IC 14 PIN	01295	C931410
A5	298935-001	1	ASSY, FIXED FREQUENCY GENERATOR	56872	298935-001
FL1	293608-001	3	FILTER CONNECTOR	72982	1201-066
FL2	293608-001		FILTER CONNECTOR	72982	1201-066
FL3	293608-001		FILTER CONNECTOR	72982	1201-066
R1	299701-180	1	RESISTOR:FXD CAR 18 OHM, ±5% 1/4W	01121	RC07GF180J
A5A1	298921-001		PWB ASSY, FIXED FREQUENCY INPUT	56872	298921-001
C1	299244-001	8	CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C2	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C3	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C4	299241-270	2	CAP:FXD DIP MICA 27PF -+5% 300WVDC	72136	DM5-270J
C5	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C6	299250-241	1	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C7	299241-270		CAP:FXD DIP MICA 27PF -+5% 300WVDC	72136	DM5-270J
C8	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C9	299250-301	3	CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
C10	299241-070	1	CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C11	299250-301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
C12	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C13	299241-120	2	CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C14	299250-301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
C15	299241-120		CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C16	299250-471	2	CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C17	299250-471		CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C18	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C19	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C20	299241-121	2	CAP:FXD DIP MICA 120PF -+5% 300WVDC	72136	DM5FY-121J
C21	293916-001	1	CAP:CER VAR 3-10PF	91293	9352
C22	299241-121		CAP:FXD DIP MICA 120PF -+5% 300WVDC	71236	DM5FY-121J
E1	293310-001	1	TERMINAL SOLDER	71279	1597-2-01
E2	293306-001	1	TERMINAL SOLDER	71279	1019-2-901
J1	299235-001	1	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-042	2	INDUCTOR:FXD MOLDED 8.2UH	99800	1025-042
L2	299237-042		INDUCTOR:FXD MOLDED 8.2UH	99800	1025-042
L3	231105-004	4	INDUCTOR:VAR .9UH	56872	231105-004
L4	299237-056	2	INDUCTOR:FXD MOLDED 33UH	99800	1025-056
L5	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L6	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L7	299237-056		INDUCTOR:FXD MOLDED 33UH	99800	1025-056
L8	231105-004		INDUCTOR:VAR .9UH	56872	231105-004
L9	231105-006	1	INDUCTOR:VAR 2UH 8 TURNS	99800	1025-048
L10	231105-007	1	INDUCTOR:VAR 2UH 16 TURNS	99800	1025-048
Q1	294151-001	2	TRANSISTOR:NPN SI	04713	2N4124
Q2	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q3	294157-001	1	TRANSISTOR:NPN SI	04713	2N3866

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A5A1 R1	299701-470	3	RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R2	299701-362	6	RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R3	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R4	299701-391	2	RESISTOR:FXD CAR 390 OHM –+5% 1/4W	01121	RC07GF391J
R5	299701-102	1	RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R6	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R7	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R8	299701-681	1	RESISTOR:FXD CAR 680 OHM –+5% 1/4W	01121	RC07GF681J
R9	299701-391		RESISTOR:FXD CAR 390 OHM –+5% 1/4W	01121	RC07GF391J
R10	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R11	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R12	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R13	299701-201	1	RESISTOR:FXD CAR 390 OHM –+5% 1/4W	01121	RC07GF201J
R14	299701-301	1	RESISTOR:FXD CAR 300 OHM –+5% 1/4W	01121	RC07GF301J
R15	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
Y1	298357-001	1	CRYSTAL:110 MHZ	56872	298357-1
A5A2	298918-001	1	PWB ASSY, 10 MHZ OUTPUT AMPLIFIER	56872	298918-001
C1	299241-360	4	CAP:FXD DIP MICA 36PF –+5% 300WVDC	72136	DM5-360J
C2	299250-241	2	CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C3	299241-360		CAP:FXD DIP MICA 36PF –+5% 300WVDC	72136	DM5-360J
C4	299244-001	6	CAP:FXD CER DISC .01UF –20+80% 1000WVDC	56289	C023F501C103Z
C5	299244-001		CAP:FXD CER DISC .01UF –20+80% 1000WVDC	56289	C023F501C103Z
C6	299241-360		CAP:FXD DIP MICA 36PF –+5% 300WVDC	72136	CM5-360J
C7	299241-360		CAP:FXD DIP MICA 36PF –+5% 300WVDC	72136	DM5-360J
C8	299250-241		CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C9	299244-001		CAP:FXD CER DISC .01UF –20+80% 1000WVDC	56289	C023F501C103Z
C10	299244-001		CAP:FXD CER DISC .01UF –20+80% 1000WVDC	56289	C023F501C103Z
C11	299244-001		CAP:FXD CER DISC .01UF –20+80% 1000WVDC	56289	C023F501C103Z
C12	299244-001		CAP:FXD CER DISC .01UF –20+80% 1000WVDC	56289	C023F501C103Z
E1	293310-001		TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
J2	299235-001	2	CONNECTOR:RT ANGLE	98291	51-353-0000
J3	299235-001		CONNECTOR:RT ANGLE	98291	51-353-0000
L1	299237-042	4	INDUCTOR:FXD MOLDED 8.2UH	99800	1025-042
L2	299237-042		INDUCTOR:FXD MOLDED 8.2UH	99800	1025-042
L3	299237-056	2	INDUCTOR:FXD MOLDED 33UH	99800	1025-056
L4	299237-042		INDUCTOR:FXD MOLDED 6.2UH	99800	1025-042

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A5A3 C15	299250-391	1	CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C16	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C17	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C18	299245-001	2	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-M058-W5R0-104M
C19	299241-430	1	CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C20	299241-070		CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C22	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C24	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C25	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-M058-W5R0-104M
C26	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
E1	293310-001	3	TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
E3	293310-001		TERMINAL SOLDER	71279	1597-2-01
J4	299235-001	1	CONNECTOR:RT ANGLE	98291	51-353-0000
L1	299237-052	1	INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L2	299237-036	3	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L3	231105-001	4	INDUCTOR:VAR .133UH	56872	231105-001
L4	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L5	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L6	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L7	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L8	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L9	299237-022	2	INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L10	299237-022		INDUCTOR:FXD MOLDED 1.2UH	99800	1025-022
L11	299237-048	1	INDUCTOR:FXD MOLDED 15UH	99800	1025-048
Q1	294151-001	1	TRANSISTOR:NPN SI	04713	2N4124
Q2	299239-001	2	TRANSISTOR:NPN SI	04713	2N5179
Q3	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R1	299701-362	2	RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R2	299701-242	2	RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R3	299701-391	3	RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R4	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R7	299701-103	1	RESISTOR:FXD CAR 10K -+5% 1/4W	01121	RC07GF103J
R8	299701-102	1	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R9	299701-362		RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R10	299701-242		RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R11	299701-391		RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J
R12	299701-471	1	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
A5A4	298917-002	1	PWB ASSY, 65 MHZ GENERATOR	56872	298917-002
C1	299244-001	6	CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C2	299241-680	2	CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C3	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C4	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C5	299245-001	1	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-M058-W5R0-104M
C7	299243-001	9	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C8	299241-030	1	CAP:FXD DIP MICA 3PF -+0.5PF 300WVDC	72136	DM5-030D
C9	293592-001	3	CAP:FXD DIP MICA 0.5PF -+0.25PF 300WVDC	93958	1C.5RC
C10	299241-070	2	CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C11	293592-001		CAP:FXD DIP MICA 0.5PF -+0.25PF 300WVDC	93958	1C.5RC
C12	299241-070		CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C13	293592-001		CAP:FXD DIP MICA 0.5PF -+0.25PF 300WVDC	93958	1C.5RC
C15	299241-120	1	CAP:FXD DIP MICA 12PF -+5% 300WVDC	72136	DM5-120J
C16	299241-430	4	CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C17	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C18	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C19	299243-001		CAP:FXD CER DISC .001UH -+20% 1000WVDC	56289	CK60AW102M
C20	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C21	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C22	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C23	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A5A4 C24	299241-101	1	CAP:FXD DIP MICA 100PF -+5% 300WVDC	72136	DM5-101J
C25	299241-750	1	CAP:FXD DIP MICA 75PF -+5% 300WVDC	72136	DM5-750J
C26	299241-020	2	CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C27	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C28	299241-010	2	CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-010D
C29	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C30	299241-010		CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-010D
C31	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C32	299241-020		CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C33	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C34	299250-241	1	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C35	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C36	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C37	299240-002	1	CAP:FXD DIP TA 22UF -+20% 15WVDC	31433	T368B226M015AS
C39	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C40	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
E1	293306-001	2	TERMINAL:DISCONNECT	71279	1019-2-901
E2	293306-001		TERMINAL:DISCONNECT	71279	1019-2-901
E3	293310-001	3	TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293310-001		TERMINAL SOLDER	71279	1597-2-01
J7	299235-001	1	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-052	2	INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L2	299237-024	2	INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L3	299237-038	5	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L4	231105-001	9	INDUCTOR:VAR .133UH	56872	231105-001
L5	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L6	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L7	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L8	299237-032	1	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L9	299237-024		INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L10	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L11	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L12	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L13	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L14	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L15	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L16	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L17	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L18	231105-001		INDUCTOR:VAR .133UH	56872	231105-001

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A5A4 XU1	294567-001	1	SOCKET:IC 16 PIN	01295	C931610
A5A5	298915-001	1	PWB ASSY, 64 MHZ GENERATOR	56872	298915-001
C1	299244-001	7	CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C2	299241-030	1	CAP:FXD DIP MICA 3PF -+0.5PF 300WVDC	72136	DM5-030D
C3	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C5	299241-010	5	CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-010D
C6	299243-001	10	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C7	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F301C103Z
C8	299241-240	1	CAP:FXD DIP MICA 24PF -+5% 300WVDC	72136	DM5-240J
C9	299241-020	3	CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM05-020D
C10	299241-330	3	CAP:FXD DIP MICA 33PF -+5% 300WVDC	72136	DM-330J
C11	299241-330		CAP:FXD DIP MICA 33PF -+5% 300WVDC	72136	DM5-330J
C12	299241-010		CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-010D
C13	299241-330		CAP:FXD DIP MICA 33PF -+5% 300WVDC	72136	DM5-330J
C14	299241-010		CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-101D
C15	299241-430	6	CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C16	299250-131	1	CAP:FXD DIP MICA 130PF -+5% 500WVDC	14655	CM04FD131J03
C17	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C18	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C19	299241-070	2	CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C20	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C21	299241-070		CAP:FXD DIP MICA 7PF -+0.5PF 300WVDC	72136	DM5-070D
C22	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C23	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C24	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C25	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C26	299241-020		CAP:FXD DIP MICA 2PF -5%PF 300WVDC	72136	DM5-020D
C27	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C28	299241-010		CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-010D
C29	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C30	299241-010		CAP:FXD DIP MICA 1PF -+0.5PF 300WVDC	72136	DM5-010D
C31	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C32	299241-020		CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C33	299241-680	1	CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C34	299250-241	1	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C35	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C36	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C37	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C38	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C39	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C40	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C41	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C42	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
E1	293310-001	6	TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
E3	293310-001		TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293310-001		TERMINAL SOLDER	71279	1597-2-01
E6	293310-001		TERMINAL SOLDER	71279	1597-2-01
J8	299235-001	1	CONNECTOR:RT ANGLE	98291	51-353-0000
L1	299237-052	3	INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L2	299237-052		INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L3	299237-032	3	INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L4	299237-038	2	INDUCTOR:FXD MOLDED 5.6UH	99800	1024-038
L5	231105-001	10	INDUCTOR:VAR .133UH	56872	231105-001
L6	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L7	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L8	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L9	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L10	299237-052		INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L11	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1025-032
L12	299237-020	3	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L13	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A5A5 L14	299237-032		INDUCTOR:FXD MOLDED 3.3UH	99800	1024-032
L15	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L16	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L17	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L18	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L19	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L20	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L21	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
Q1	294151-001	1	TRANSISTOR:NPN SI	04713	2N4124
Q2	299239-001	3	TRANSISTOR:NPN SI	04713	2N5179
Q3	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q4	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R1	299701-362	3	RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R2	299701-242	4	RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R3	299701-301	2	RESISTOR:FXD CAR 300 OHM –+5% 1/4W	01121	RC07GF301J
R4	299701-102	2	RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R5	299701-103	1	RESISTOR:FXD CAR 10K –+5% 1/4W	01121	RC07GF103J
R6	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R7	299701-101	1	RESISTOR:FXD CAR 100 OHM –+5% 1/4W	01121	RC07GF101J
R8	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R9	299701-242		RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R10	299701-391	2	RESISTOR:FXD CAR 390 OHM –+5% 1/4W	01121	RC07GF391J
R11	299701-391		RESISTOR:FXD CAR 390 OHM –+5% 1/4W	01121	RC07GF391J
R12	299701-301		RESISTOR:FXD CAR 300 OHM –+5% 1/4W	01121	RC07GF301J
R13	299701-470	1	RESISTOR:FXD CAR 47 OHM ±5% 1/4W	01121	RC07GF470J
R14	299701-362		RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R15	299701-242		RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R16	299701-681	1	RESISTOR:FXD CAR 680 OHM –+5% 1/4W	01121	RC07GF681J
R17	299701-242		RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R22	299701-152	1	RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R23	299701-391		RESISTOR:FXD CAR 390 OHM –+5% 1/4W	01121	RC07GF391J
U1	293350-001	2	IC:TTL DUAL J-K FF	01295	SN74S113N
U2	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
XU1	294573-001	2	SOCKET:IC 14 PIN	01295	C931410
XU2	294573-001		SOCKET:IC 14 PIN	01295	C931410
A5A6	298926-001	1	PWB ASSY, 35/35.5 MHZ GENERATOR	56872	298926-001
C1	299244-001	6	CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z
C2	299241-050	3	CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	DM5-050D
C3	299244-001		CAP:FXD CER DISC .01UF -20+80% 1000WVDC	56289	C023F501C103Z

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A5A6 C31	299241-040	1	CAP:FXD DIP MICA 4PF -+0.5PF 300WVDC	72136	DM5-040D
C32	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C33	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
CR1	293200-001		DIODE:SIGNAL	01295	IN645
E1	293310-001	4	TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
E3	293310-001		TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293306-001	1	TERMINAL SOLDER	71279	1019-2-901
J6	299235-001	1	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-020	4	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L2	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-022
L3	231105-001	2	INDUCTOR:VAR .133UH	56872	231105-001
L4	299237-052	4	INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L5	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L6	299237-038	2	INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L7	299237-052		INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L8	299237-052		INDUCTOR:FXD MOLDED 22UH	99800	1025-052
L9	299237-038		INDUCTOR:FXD MOLDED 5.6UH	99800	1025-038
L10	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L11	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L12	299237-052		INDUCTOR:FXD MOLDED 22UH	99800	1025-052
Q1	294172-001	5	TRANSISTOR:NPN SI	04713	MPS918
Q2	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q3	294151-001	2	TRANSISTOR:NPN SI	04713	2N4124
Q4	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q5	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q6	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q7	294151-001		TRANSISTOR:NPN SI	04713	2N4124
Q8	294153-001	1	TRANSISTOR:PNP SI	04713	2N4126
R1	299701-622	11	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R2	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R3	299701-102	4	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R4	299701-471	3	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R5	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R6	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R7	299701-180	2	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R8	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R9	299701-622	2	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R10	299701-681	2	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R11	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R12	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R13	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R14	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R15	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R16	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R18	299701-471		RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R19	299701-101	2	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R20	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R21	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R22	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R23	299701-180		RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R24	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R25	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R26	299701-472	2	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R27	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R28	299701-161	1	RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
R29	299701-201	1	RESISTOR:FXD CAR 200 OHM -+5% 1/4W	01121	RC07GF201J
U1	293350-001	1	IC:TTL DUAL J-K FF	01295	SN74S113N
U2	293496-001	1	IC:TTL DECADE COUNTER	18324	82S90
XU1	294573-001	2	SOCKET:IC 14 PIN	01295	C931410
XU2	294573-001		SOCKET:IC 14 PIN	01295	C931410

INCLUDES 3D GLASSES

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A11A1	298997-001	1	PWB ASSY, POWER SUPPLY RECT/FILT	56872	298997-001
C1	293911-001	4	CAP:FXD AL 2200UF @25 -10%+50%	52763	EG2T/25
C2	293911-001		CAP:FXD AL 2200UF @25 -10%+50%	52763	EG2T/25
C3	293911-001		CAP:FXD AL 2200UF @25 -10%+50%	52763	EG2T/25
C4	293911-001		CAP:FXD AL 2200UF @25 -10%+50%	52763	EG2T/25
C5	293912-001	4	CAP:FXD AL 2200UF 35/40V -10%+50%	52763	EG2T/40
C6	293912-001		CAP:FXD AL 2200UF 35/40V -10%+50%	52763	EG2T/40
C7	293912-001		CAP:FXD AL 2200UF 35/40V -10%+50%	52763	EG2T/40
C8	293912-001		CAP:FXD AL 2200UF 35/40V -10%+50%	52763	EG2T/40
E1	293050-001	7	TERMINAL:DISCONNECT	71279	61137-1
F1	294713-001	2	FUSE: 1AG 32V 7.5AMP	75915	30107-5
F2	294713-001		FUSE: 1AG 32V 7.5AMP	75915	30107-5
R1	299702-202	2	RESISTOR:FXD CAR 2K -+5% 1/2W	01121	RC07GF202J
R2	299702-202		RESISTOR:FXD CAR 2K -+5% 1/2W	01121	RC07GF202J
A11A2	298998-001	1	PWB ASSY, +5.2 VOLT REGULATOR	56872	298998-001
C1	115307-031	3	CAP:FXD AL 200UF -10%+75% 25WVDC	56289	TE1213
C2	293915-001	1	CAP:FXD CER DISC .02UF -+20% 100WVDC	56289	TGS20
C3	115307-031		CAP:FXD AL 200UF -10%+75% 25WVDC	56289	TE1213
C4	299250-471	1	CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C5	115307-010	1	CAP:FXD AL 100UF -10%+75% 25WVDC	56289	TE1211
C6	115307-031		CAP:FXD AL 200UF -10%+75% 25WVDC	56289	TE1213
CR1	293202-001	2	DIODE RECTIFIER	04713	IN4001
CR2	293202-001		DIODE RECTIFIER	04713	IN4001
E1	293310-001	4	TERMINAL SOLDER	71279	1597-2-01
R1	299796-001	1	RESISTOR:FXD MLD .05 OHM 3% 2W	91637	LVR-2
R2	299701-102	1	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R3	299702-322	1	RESISTOR:FXD FLM 1K -+5% 1/4W	01121	RN60C1001F
R4	299701-421	1	RESISTOR:FXD FLM 10K -+5% 1/4W	01121	RN60C1002F
R5	299709-359	1	RESISTOR:FXD FLM 2.43K -+1% 1/4W	01121	RN60D2431F
R6	299709-400	1	RESISTOR:FXD FLM 6.04K -+1% 1/4W	01121	RN60D6041F
R7	299701-681	2	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R1	299701-681		RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R9	299701-242	1	RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R10	299745-006	1	RESISTOR:VAR 500 OHM 3/4W	80294	3009P-1-501
R11	299701-391	1	RESISTOR:FXD CAR 390 OHM -+5% 1/4W	01121	RC07GF391J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A11A3 R10	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R11	299701-362	1	RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R12	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
U1	293502-001	1	IC:LIN VOLTAGE REGULATOR	04713	MC1723CL
U2	293511-001	1	IC:LIN OP AMP	72314	UA741TC
XU1	294573-001	1	IC:SOCKET 14 PIN	01295	C931410
XU2	294565-001	1	IC:SOCKET 16 PIN	01295	C930810
A11A4	298928-001	1	PWB ASSY, POWER SUPPLY MOTHERBOARD	56872	298928-001
J1	294408-004	3	CONNECTOR:PC EDGE	05574	3VH10/IJ12
J2	294408-004		CONNECTOR:PC EDGE	05574	3VH10/IJ12
J3	294408-004		CONNECTOR:PC EDGE	05574	3VH10/IJ12
J4	293080-001	10	CONNECTOR, POST	00779	86091-4
J5	293080-001	10	CONNECTOR, POST	00779	86091-4
A12	296407-001	1	ASSY REAR PANEL (FIGURE 6-50)	56872	296407-001
B1	299256-001	1	FAN	28875	MWSZ107FL-7
F1	990019-030	1	FUSE 3 AMP 115V	56872	990019-030
	990019-028	1	FUSE 1.5 AMP 230V	56872	990019-028
Q1	294175-001	2	TRANSISTOR	04713	2N6055
Q2	294175-001		TRANSISTOR	04713	2N6055
T1	299809-001	1	TRANSFORMER ASSY	56872	299809-001
	294439-001	1	CONNECTOR, BNC, SWP OUT	02660	UG1094/U-1050
	294695-001	1	LINE RECEPTACLE	05245	6J4
W11	299297-011	1	CABLE ASSY COAX, 5/10 MHZ REF IN	56872	299297-010
W13	299297-013	1	CABLE ASSY COAX, 10 MHZ REF OUT	56872	299297-013
W25	299297-025	1	CABLE ASSY COAX, 10 MHZ INT STD OUT	56872	299297-025
	231857-001	1	CABLE ASSY	56872	231857-001
A12A1	299261-001	1	PWB ASSY, RELAY ASSEMBLY	56872	299261-001
E1	293310-001	4	TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
E3	293310-001		TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
K1	294787-001	1	RELAY SPDT, 6 AMP	82050	BC69-10
R1	299703-200	1	RESISTOR:FXD CAR 20 OHM -+5% 1/2W	01121	RC32GF200J
A14	299201-001	1	PWB ASSY, LOGIC/POWER DISTRIBUTION	56872	299201-001
C1	115307-010	2	CAP:FXD AL 100UF -10%+75% 25WVDC	56289	TE1211
C2	115307-010		CAP:FXD AL 100UF -10%+75% 25WVDC	56289	TE1211
CR1	293203-001	1	DIODE ZENER 6.2V -+5%	04713	IN753A
CR2	293204-001	1	DIODE ZENER 15V -+5%	04713	IN30248
CR3	293291-001	1	DIODE	30992	VZ16DC1
E1	293310-001	8	TERMINAL SOLDER	71279	1597-2-01
J1	293080-001	16	CONNECTOR POST	00779	86091-4
J2	293080-001	10	CONNECTOR POST	00779	86091-4
J3	293080-001	10	CONNECTOR POST	00779	86091-4
J4	299932-001	3	HEADER:DOUBLE ROW 26 PINS	00779	1-87227-3
J5	299932-001		HEADER:DOUBLE ROW 26 PINS	00779	1-87227-3
J6	299932-001		HEADER:DOUBLE ROW 26 PINS	00779	1-87227-3
J7	293080-001	10	CONNECTOR POST	00779	86091-4
J8	293080-001	16	CONNECTOR POST	00779	86091-4
J9	293080-001	10	CONNECTOR POST	00779	86091-4
R1	299701-101	4	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R2	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R3	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R4	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R5	299701-681	1	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R6	299701-821	1	RESISTOR:FXD CAR 820 OHM -+5% 1/4W	01121	RC07GF821J
SCR1	294154-001	2	RECTIFIER, SILICON CONTROLLED	04713	2N4172
SCR2	294154-001		RECTIFIER, SILICON CONTROLLED	04713	2N4172
A15	296387-003	1	ASSY, MPU	56872	296387-003
W1	296400-001	1	ASSY CABLE	56872	296400-001
A15A1	296351-006	1	ASSY MPU PC BOARD	56872	296351-006
C1	299240-005	1	CAP:FXD CER 68UF -+20% 15WVDC	31433	T362C686M015AS
C2	299245-001	24	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A15A1C3	299250-151	1	CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03
C4	299250-391	1	CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C5	299240-002	2	CAP:FXD CER 22UF -+20% 15WVDC	31433	T368B226M015AS
C6	299240-002		CAP:FXD CER 22UF -+20% 15WVDC	31433	T368B226M015AS
C7	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C8	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C9	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C10	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C11	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C12	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C13	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C14	299241-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C15	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C16	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C17	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C18	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C19	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C20	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C21	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C22	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C23	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C24	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C25	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C26	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C27	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C28	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C29	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
J1	294452-002	1	HEADER:RIGHT ANGLE, 60 PIN	00779	3-87230
J2	299934-005	1	HEADER:STRAIGHT, 40 PIN	00779	2-87227
J3	294213-005	1	HEADER:RIGHT ANGLE, 34 PIN	00779	1-87230-7
L1	299237-044	1	INDUCTOR:FXD MOLDED 10UH	99800	1025-44
R1	299700-103	2	RESISTOR:FXD CAR 10K -+5% 1/8W	01121	RC05GF103J
R2	299701-102	3	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R3	299700-302	2	RESISTOR:FXD CAR 3K -+5% 1/8W	01121	RC05GF302J
R4	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R5	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R6	299700-103		RESISTOR:FXD CAR 10K -+5% 1/8W	01121	RC05GF103J
R7	299700-302		RESISTOR:FXD CAR 3K -+5% 1/8W	01121	RC07GF302J
R8	299700-180	2	RESISTOR:FXD CAR 18 OHM -+5% 1/8W	01121	RC05GF180J
R9	299700-180		RESISTOR:FXD CAR 18 OHM -+5% 1/8W	01121	RC05GF180J
R10	299700-680	1	RESISTOR:FXD CAR 68 OHM -+5% 1/8W	01121	RC05GF680J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A15A1 U25	293437-001	1	IC:QUAD AND GATE	01295	SN74LS08N
U26	294035-004	1	IC:CLOCK GENERATOR	04713	MC6875P
U27	293438-001		IC:QUAD OR GATE	01295	SN74LS32N
U28	293438-001		IC:QUAD OR GATE	01295	SN74LS32N
U29	296466-001	1	IC:QUAD OR GATE	01295	SN74S32N
XU6	294566-001	4	IC:SOCKET, 24 PIN	01295	C932410
XU7	294574-001	2	IC:SOCKET, 18 PIN	01295	C931810
XU9	294574-001		IC:SOCKET, 18 PIN	01295	C931810
XU11	294566-001		IC:SOCKET, 24 PIN	01295	C932410
XU12	294566-001		IC:SOCKET, 24 PIN	01295	C932410
XU14	294566-001		IC:SOCKET, 24 PIN	01295	C932410
XU17	296468-001	2	IC:SOCKET, 40 PIN	01295	C934010
XU18	294595-001	1	IC:SOCKET, 20 PIN	01295	C932010
XU20	296468-001		IC:SOCKET, 40 PIN	01295	C934010
XU26	294567-001	1	IC-SOCKET, 16 PIN	01295	C931610
Y1	296489-001	1	CRYSTAL, 4 MHz	71450	MP04A
	296542-001	1	1 MHZ CLOCK OSCILLATOR, PC BOARD	56872	296542-001
C1	299240-2	1	CAPACITOR, 22UF, 15V	31433	T368B226M015AS
C2	293294-2	2	CAPACITOR, 0.1UF	71590	CY20104P
C3	299240-5	1	CAPACITOR, 68UF, 15V	31433	T362C686M015AS
C4	293294-2		CAPACITOR, 0.1UF	71590	CY20104P
C5	299250-101	1	CAPACITOR, 100PF	14655	CM04FD101J03
CR1	293240-1	1	DIODE	04713	IN914
P1	296454-1	1	SOCKET, ADAPTER	91506	616AG16
R1	299700-102	1	RESISTOR, 1K, 1/8W, 5%	01121	RC05GF102J
R2	299700-394	1	RESISTOR, 390K, 1/8W, 5%	01121	RC05GF394J
R3	299700-180	1	RESISTOR, 18 OHM, 1/8W, 5%	01121	RC05GF180J
U1	296538-1	1	IC, CLOCK	01295	6871B4FC
U2	293536-1	1	IC, FLIP FLOP	01295	74LS74N
U3	293541-25	1	QUAD POS NAND	01295	74LS132
U4	293540-1	1	HEX INVERTER	01295	74LS04
U5	293466-1	1	MONOSTABLE VIBRATOR	01295	74121N
A15A2	296353-003	1	ASSY LATCH PC BOARD	56872	296353-003
C1	296458-001	1	CAP.FXD .01 UF 5% 400WVDC	14655	CMK.01
C2	299245-002	1	CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C3	299250-151	1	CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03
C4	299245-001	19	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C5	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C6	299240-005	2	CAP:FXD TA 68UF -+20% 15WVDC	31433	T362C686M015AS
C7	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C8	299240-002	1	CAP:FXD TA 22UF -+20% 15WVDC	31433	T368B226M015AS
C9	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C10	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C11	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C12	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C13	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C14	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C15	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C16	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C17	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C18	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C19	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C20	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C21	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C22	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C23	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C24	299240-005		CAP:FXD TA 68UF -+20% 15WVDC	31433	T362C686M015AS
C25	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
J1	294452-002	1	HEADER:RIGHT ANGLE 60 PIN	00779	3-87230-0
J2	299934-004	1	HEADER:STRAIGHT 50 PIN	00779	2-87227-5
J3	294213-002	1	HEADER:RIGHT ANGLE 6 PIN	00779	87230-3
L1	299237-044	2	INDUCTOR:FXD MOLDED 10UH	99800	1025-44
L2	299237-044		INDUCTOR:FXD MOLDED 10UH	99800	1025-44

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A15A2 R1	299700-472	1	RESISTOR:FXD CAR 4.7K -+5% 1/8W	01121	RC05GF472J
R2	299707-383	1	RESISTOR:FXD FLM 4.42K 1% 1/10W	01121	RN55C4421F
R3	299707-534	1	RESISTOR:FXD FLM 143K 1% 1/10W	01121	RN55C1433F
R4	299707-367	1	RESISTOR:FXD FLM 3.01K 1% 1/10W	01121	RN55C3011F
R5	299707-321	1	RESISTOR:FXD FLM 1K 1% 1/10W	01121	RN55C1001F
R6	299745-010	1	RESISTOR:VARIABLE 10K	80294	3009P-1-103
TP1	293310-001	1	TERMINAL SOLDER	71279	1597-2-01
U1	294461-003	12	IC:OCTAL LATCH	04713	MM74C374N
U2	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U3	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U4	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U5	294066-001	1	IC:OPNL AMPL	75915	LF356N
U6	293536-001	1	IC:DUAL D FLIP-FLOP	01295	SN74LS74N-00
U7	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U8	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U9	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U10	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U11	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U12	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U13	293545-001	1	IC:QUAD NOR GATE	01295	SN74LS02N-00
U14	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U15	294461-003		IC:OCTAL LATCH	04713	MM74C374N
U16	293541-023	1	IC:OCTAL LATCH	01295	SN74LS373N
U17	294461-002	2	IC:HEX LATCH	04713	MM74C174N
U18	293691-006	2	IC:RES NTWK 10K	01121	316A103
U19	294461-002		IC:HEX LATCH	04713	MM74C174N
U20	296457-001	1	IC:TIMER	18324	NE555
U21	294461-004	1	IC:HEX INVERTER	04713	MM74C901N
U22	294461-005	1	IC:4-16 DECODER	04713	MM74C154N
U23	294593-002	1	IC:D TO A CONVERTER	24355	AD7520LN
U24	293541-007	1	IC:TRI STATE BUFFER	01295	SN74LS244N
U25	293691-006		IC:RES NTWK 10K	01121	316A103
XU23	294567-001	1	IC:SOCKET 16 PIN	01295	C931610
A15A3	296355-001	1	ASSY GPIB PC BOARD	56872	296355-001
C1	299240-002	1	CAP:FXD TA 22UF -+20% 15WVDC	31433	T368B226M015AS
C2	299245-001	17	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C3	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C4	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M
C5	299245-001		CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-050-651-104M

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A15A3 U8	296469-001		IC-QUAD TRANSCEIVER	04713	MC3448A
U9	296462-001	1	IC:OCTAL TRANSCEIVER	27014	DP8304BN
U10	293545-001	1	IC:QUAD NOR GATE	01295	SN74LS02N-00
U11	293438-001	1	IC:QUAD OR GATE	01295	SN74LS32N
U12	293536-001	1	IC:DUAL D FLIP-FLOP	01295	SN74LS74N-00
U13	296470-001	1	IC:GPIB ADAPTER	04713	MC68488P
U14	293533-001	1	IC:TRIPLE 3 IN NAND	01295	SN74LS10N
U15	293437-001		IC:QUAD AND GATE	01295	SN74LS08N
U16	293691-006	1	IC:RESISTOR NTWK 10K	01121	316A103
U17	293541-007	1	IC:OCTAL BUFFER	01295	SN74LS244N
XU13	296468-001	1	SOCKET:IC 40 PIN	01295	C934010
A15PS1	296428-001	1	ASSY POWER SUPPLY +5VDC 5A	34050	83-1223A
BR1		1	RECTIFIER BRIDGE 200V 25 AMP	21845	JS27-2A
C1		1	CAP·FXD ELCTLT 12,000UF 20WVDC	00853	DCM123U025AB2B
Q1	294132-001	1	TRANSISTOR:NPN	04713	2N3055
T1		1	TRANSFORMER	34050	B37-0007
A15PS1A1		1	POWER SUPPLY +5V PC BOARD ASSY	34050	C90-0021
C1		1	CAP:AL ELCTLT 100UF 25WVDC	1H847	3070DE101T025SF
C2		1	CAP:FILM DIELECTRIC MYLAR .01UF 100WVDC	14655	WMF1S1
C3		2	CAP:AL ELCTLT 47UF 10WVDC	1H847	3070BA470T010SF
C4			CAP:AL ELCTLT 47UF 10WVDC	1H847	3070BA470T010SF
CR1	4500040000	3	DIODE	72314	1N4004
CR2	4500040000		DIODE	72314	1N4004
CR3	4500040000		DIODE	72314	1N4004
CR4		1	DIODE·ZENER	04713	1N751A
CR5		1	SCR RECTIFIER	19089	S2800A
Q1		1	TRANSISTOR	04713	2N5294
R1	299701-470	1	RESISTOR:FXD CAR 47 OHM ±5% 1/4W	01121	RC07GF470J
R2	299701-223	1	RESISTOR:FXD CAR 22K ±5% 1/4W	01121	RC07GF223J
R3	299701-102	1	RESISTOR:FXD CAR 1K ±5% 1/4W	01121	RC07GF102J
R4		1	RESISTOR:FXD FLM 3.24K -+1% 1/8W	01121	RN60C3240F
R5	299701-472	2	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R6	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R7	299709-315	1	RESISTOR:FXD FLM 866 OHM -+1% 1/8W	01121	RN60C8660F
R8	299709-267	1	RESISTOR:FXD FLM 3.01K -+1% 1/8W	01121	RN60C3010F
R9	299701-220	1	RESISTOR:FXD CAR 220 OHM -+5% 1/4W	01121	RC07GF220J
R10	299701-471	1	RESISTOR:FXD CAR 470 OHM -+5% 1/4W	01121	RC07GF471J
R11		1	RESISTOR:FXD CAR .1 OHM 3W	34050	12-0141
R12		1	RESISTOR:VAR 1K	•	PT10CH2,51000
U1		1	IC:REGULATOR	72314	UA723HC
	298936-001	1	FREQUENCY EXTENDER 3600E1	56872	298936-001
W1	231860-001	1	FREQUENCY EXTENDER HARNESS ASSEMBLY	56872	231860-001
W15	299297-015	1	CABLE ASSEMBLY, COAXIAL	56872	299297-015
W16	299297-016	1	CABLE ASSEMBLY, COAXIAL	56872	299297-016
W17	299297-017	1	CABLE ASSEMBLY, COAXIAL	56872	299297-017
W19	299297-019	1	CABLE ASSEMBLY, COAXIAL	56872	299297-019
W20	299297-020	1	CABLE ASSEMBLY, COAXIAL	56872	299297-020
W21	299297-021	1	CABLE ASSEMBLY, COAXIAL	26872	299297-021
W22	299297-022	1	CABLE ASSEMBLY, COAXIAL	56872	299297-022
A6	298938-001	1	ASSY, 24/33 MHZ OSCILLATOR	56872	298938-001
FL1	293609-001	6	FILTER CONNECTOR	72982	1201-066
FL2	293609-001		FILTER CONNECTOR	72982	1201-066
FL3	293609-001		FILTER CONNECTOR	72982	1201-066
FL4	293609-001		FILTER CONNECTOR	72982	1201-066
FL5	293609-001		FILTER CONNECTOR	72982	1201-066
FL6	293609-001		FILTER CONNECTOR	72982	1201-066
J1	299233-001	2	CONNECTOR:ST BULKHEAD	98291	51-045-0000
J2	299233-001		CONNECTOR:ST BULKHEAD	98291	51-045-0000
A6A1	298949-001	1	PWB ASSY, 24/33 MHZ OSCILLATOR	56872	298949-001
C1	299253-001	7	CAP:FXD POR 2.7PF -+0.5PF 500WVDC	95275	V/10CA2R7DER
C2	299241-430	10	CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C3	293593-001	10	CAP:VAR TRMR 2-8PF	91293	8090
C4	299250-391	10	CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C5	299253-001		CAP:FXD POR 2.7PF -+5% 500WVDC	75275	VY10CA2R7DER
C6	299241-430		CAP:FXD DIP MICA 43PF -+5% 300 WVDC	72136	DM5-430J
C7	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C8	299250-391		CAP:FXD DIP MICA 390PF -5% 100WVDC	14655	CM04FA391J03
C9	299253-001		CAP:FXD POR 2.7PF -+0.5PF 500WVDC	95275	VY10CA2R7DER
C10	299241-430		CAP:FXD DIP MICA 43PF -5% 300WVDC	72136	DM5-430J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A6A1C11	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C12	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C13	299253-001		CAP:FXD POR 2.7PF -+0.5PF 500WVDC	95275	VY10CA2R7DER
C14	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C15	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C16	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C17	299253-002	3	CAP:FXD POR 8.2PF -+5% 500WVDC	95275	VY10A8R2J3
C18	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C19	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C20	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C21	299253-001		CAP:FXD POR 2.7PF -+0.5PF 500WVDC	95275	VY10CA2R7DER
C22	299241-430		CAP:FSC DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C23	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C24	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C25	299253-001		CAP:FXD POR 2.7PF -+0.5PF 500WVDC	95275	VY10CA2R7DER
C26	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C27	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C28	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C29	299253-001		CAP:FXD POR 2.7PF -+0.5PF 500WVDC	95275	VY10CA2R7DER
C30	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C31	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C32	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C33	299253-002		CAP:FXD POR 8.2PF -+5% 500WVDC	95275	VY10A8R2JE
C34	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C35	293593-001		CAP:VAR TRMR 2-8PF	91293	8090
C36	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C37	299253-002		CAP:FXD POR 8.2PF -+5% 500WVDC	95275	VY10A8R2JE
C38	299241-430		CAP:FXD DIP MICA 43PF -+5% 300WVDC	72136	DM5-430J
C39	293593-001		CAP:VAR TRMS 2-8PF	91293	8090
C40	299250-391		CAP:FXD DIP MICA 390PF -+5% 100WVDC	14655	CM04FA391J03
C41	299243-001	11	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C42	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C43	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C44	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C45	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C46	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C48	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C49	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C50	299240-001	2	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C51	299240-001		CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A6A1Q4	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q5	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q6	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q7	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q8	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q9	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q10	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q11	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q12	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q13	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q14	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q15	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q16	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q17	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q18	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q19	294172-001		TRANSISTOR:NPN SI	04713	MPS918
Q20	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q21	294172-001		TRANSISTOR:NPN SI	04713	MPS918
R1	299701-203	10	RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R2	299701-472	22	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R3	299701-822	10	RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R4	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R5	299701-152	10	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R6	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R7	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R8	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R9	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R10	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R11	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R12	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R13	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R14	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R15	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R16	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R17	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R18	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R19	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R20	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R21	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R22	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R23	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R24	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R25	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R26	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R27	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R28	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R29	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R30	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R31	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R32	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R33	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R34	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R35	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R36	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R37	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R38	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R39	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R40	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R41	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J
R42	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R43	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R44	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R45	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R46	299701-203		RESISTOR:FXD CAR 20K -+5% 1/4W	01121	RC07GF203J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A6A1R47	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R48	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R49	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R50	299701-152		RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R51	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R52	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R53	299701-301	2	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R55	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R56	299701-470	1	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
U1	293501-001	1	IC:TTL4 TO 10 LINE DECODER	01295	SN7442N
U2	293350-001	1	IC:TTL DUAL J-K F-F	01295	SN74S113N
XU1	294567-001	1	SOCKET:IC 16 PIN	01295	C931610
XU2	294573-001	1	SOCKET:IC 14 PIN	01295	C931410
A6A2	298952-001	1	PWB ASSY, ISOL/DIVIDER	56872	298952-001
A1	299254-001	1	POWER DIVIDER	15542	MCL-PSC-2-1
C1	299243-001	4	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C2	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C3	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C4	299241-360	2	CAP:FXD DIP MICA 36PF -+5% 300WVDC	72136	DM5-360J
C5	299250-241	2	CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C6	299241-200	1	CAP:FXD DIP MICA 20PF -+5% 300WVDC	72136	DM5-200J
C7	299250-241		CAP:FXD DIP MICA 240PF -+5% 500WVDC	14655	CM04FD241J03
C8	299241-360		CAP:FXD DIP MICA 36PF -+5% 300WVDC	72136	DM5-360J
C9	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
E1	293310-001	3	TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293310-001		TERMINAL SOLDER	71279	1597-2-01
L1	299237-042	1	INDUCTOR:FXD MOLDED 8.2UH	99800	1025-042
L2	299237-020	2	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L3	299237-000	2	INDUCTOR:FXD MOLDED .15UH	99800	1025-00
L4	299237-024	1	INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L5	299237-000		INDUCTOR:FXD MOLDED .15UH	99800	1025-00
L6	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
Q1	294172-001	1	TRANSISTOR:NPN SI	04713	MPS918
R1	299701-680	1	RESISTOR:FXD CAR 68 OHM -+5% 1/4W	01121	RC07GF680J
R2	299701-101	4	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R3	299701-470	1	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R4	299701-472	2	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R5	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R6	299701-620	1	RESISTOR:FXD CAR 620 OHM -+5% 1/4W	01121	RC07GF621J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A6A3L3	299237-020	2	INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
L4	299237-000	2	INDUCTOR:FXD MOLDED .15UH	99800	1025-00
L5	299237-024	1	INDUCTOR:FXD MOLDED 1.5UH	99800	1025-024
L6	299237-000		INDUCTOR:FXD MOLDED .15UH	99800	1025-00
L7	299237-020		INDUCTOR:FXD MOLDED 1.00UH	99800	1025-020
Q1	294172-001	2	TRANSISTOR:NPN SI	04713	MPS918
Q2	294172-001		TRANSISTOR:NPN SI	04713	MPS918
R1	299701-680	1	RESISTOR:FXD CAR 68 OHM -+5% 1/4W	01121	RC07GF680J
R2	299701-470	1	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R3	299701-472	2	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R4	299701-472		RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R5	299701-301	2	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R6	299701-101	2	RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R7	299701-622	1	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R8	299701-362	1	RESISTOR:FXD CAR 3.6K -+5% 1/4W	01121	RC07GF362J
R9	299701-101		RESISTOR:FXD CAR 100 OHM -+5% 1/4W	01121	RC07GF101J
R10	299701-201	1	RESISTOR:FXD CAR 200 OHM -+5% 1/4W	01121	RC07GF201J
R11	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R12	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
A7	298961-001	1	366 MHZ FILTER/CONVERTER ASSEMBLY	56872	298961-001
C1	295374-001	4	CAP: VAR 3-10PF	91293	5201
C2	295374-001		CAP: VAR 3-10PF	91293	5201
C3	295374-001		CAP: VAR 3-10PF	91293	5201
C4	295374-001		CAP: VAR 3-10PF	91293	5201
FL1	293608-001	1	FILTER CONNECTOR	72982	1201-066
J1	299233-001	4	CONNECTOR:ST BULKHEAD	98291	51-045-0000
J2	299233-001		CONNECTOR:ST BULKHEAD	98291	51-045-0000
J3	299233-001		CONNECTOR:ST BULKHEAD	98291	51-045-0000
J4	299233-001		CONNECTOR:ST BULKHEAD	98291	51-045-0000
A7A1	298962-001	1	PWB ASSY, 366 MHZ FILT/CONV INPUT	56872	298962-001
C1	293746-001	2	CAP:VAR TRMR CER 5.5-18PF	72982	538-011-A-5.5-18
C2	299243-001	6	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C3	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C4	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C5	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C6	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C7	293746-001		CAP:VAR TRMR CER 5.5-18PF	72982	538-011-A-5.5-18
C8	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
E2	293310-001	1	TERMINAL, SOLDER	71279	1597-2-01
L1	299237-012	2	INDUCTOR, MOLDED .47UH	99800	1025-012
L2	299237-012		INDUCTOR, MOLDED .47UH	99800	1025-012
M1	231104-001	1	MIXER	15542	SRA-1
Q1	299239-001	2	TRANSISTOR	04713	2N5179
Q2	299239-001		TRANSISTOR	04713	2N5179
R1	299701-180	2	RESISTOR:FXD CAR 18 OHM, 1/4W	01121	RC07GF180J
R2	299701-622	4	RESISTOR:FXD CAR 6.2K, 1/4W	01121	RC07GF622J
R3	299701-622		RESISTOR:FXD CAR 6.2K, 1/4W	01121	RC07GF622J
R4	299701-471	2	RESISTOR:FXD CAR 470 OHM, 1/4W	01121	RC07GF471J
R5	299701-471		RESISTOR:FXD CAR 470 OHM, 1/4W	01121	RC07GF471J
R6	299701-622		RESISTOR:FXD CAR 6.2K, 1/4W	01121	RC07GF622J
R7	299701-622		RESISTOR:FXD CAR 6.2K, 1/4W	01121	RC07GF622J
R8	299701-102	1	RESISTOR:FXD CAR 1K, 1/4W	01121	RC07GF102J
R9	299701-180		RESISTOR:FXD CAR 18 OHM, 1/4W	01121	RC07GF180J
R10	299701-161	1	RESISTOR:FXD CAR 160 OHM, 1/4W	01121	RC07GF161J
				00779	
				07047	
A7A2	298963-001	1	PWB ASSY, 366 MHZ FILT/CONV OUTPUT	56872	298963-001
C9	299243-001	5	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C10	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C11	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C12	299245-004	2	CAP:FXD CER .001UF -+20% 50WVDC	56289	8121-M058-W5R0-102K

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A7A2C13	293746-001	2	CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C14	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C15	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C16	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C17	299245-004		CAP:FXD CER .001UF –+20% 50WVDC	56289	8121-M058-W5R0-102K
C18	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C19	299250-471	2	CAP:FXD DIP MICA 470PF –+5% 500WVDC	14655	CM06FD471J03
C20	299250-241	2	CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C21	299250-241		CAP:FXD DIP MICA 240PF –+5% 500WVDC	14655	CM04FD241J03
C22	299250-471		CAP:FXD DIP MICA 470PF –+5% 500WVDC	14655	CM06FD471J03
E2	293310-001	2	TERMINAL SOLDER	71279	1597-2-01
E3	293310-001		TERMINAL SOLDER	71279	1597-2-01
L3	299237-012	4	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L4	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L5	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L6	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L7	231105-001	2	INDUCTOR:VAR .133UH	56872	231105-001
L8	299237-026	1	INDUCTOR:FXD MOLDED 1.8UH	99800	1025-026
L9	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
M2	231104-001	1	MIXER	15542	SRA-1
Q3	299239-001	2	TRANSISTOR:NPN SI	04713	2N5179
Q4	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R11	299701-180	1	RESISTOR:FXD CAR 18 OHM –+5% 1/4W	01121	RC07GF180J
R12	299701-622	4	RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R13	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R14	299701-102	2	RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R15	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R16	299701-622		RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R17	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
A8	298954-001	1	361/370 MHZ FILTER AMPL ASSEMBLY	56872	298954-001
C1	295374-001	7	CAP:VAR 3-10PF	91293	5201
C2	295374-001		CAP:VAR 3-10PF	91293	5201
C3	295374-001		CAP:VAR 3-10PF	91293	5201
C4	295374-001		CAP:VAR 3-10PF	91293	5201
C5	295374-001		CAP:VAR 3-10PF	91293	5201
C6	295374-001		CAP:VAR 3-10PF	91293	5201
C7	295374-001		CAP:VAR 3-10PF	91293	5201
FL1	293608-001	1	FILTER CONNECTOR	72982	1201-066

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A8A2C4	293746-001	2	CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C5	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C6	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C7	293746-001		CAP:FXD TRMR CER 2-8PF	72982	538-011-A-2-8
C8	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C9	299241-080	2	CAP:FXD DIP MICA 8PF -+0.5PF 300WVDC	72136	DM5-080D
C10	299241-080		CAP:FXD DIP MICA 8PF -+0.5PF 300WVDC	72136	DM5-080D
C11	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C12	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
E2	293310-001	1	TERMINAL SOLDER	71279	1597-2-01
L1	299237-012	4	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L2	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L3	298899-002	3	INDUCTOR:FXD .04UH	56872	298899-002
L4	298899-002		INDUCTOR:FXD .04UH	56872	298899-002
L5	298899-002		INDUCTOR:FXD .04UH	56872	298899-002
L6	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L7	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
Q1	299239-001	2	TRANSISTOR:NPN SI	04713	2N5179
Q2	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R1	299701-180	2	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R2	299701-622	4	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R3	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R4	299701-242	1	RESISTOR:FXD CAR 2.4K -+5% 1/4W	01121	RC07GF242J
R5	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R6	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R7	299701-152	1	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R8	299701-180		RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R9	299701-301	1	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
A9	298959-001		330/331 MHZ FILTER AMPL ASSEMBLY	56872	298959-001
C1	295374-001	5	CAP:VAR 3-10PF	91293	5201
C2	295374-001		CAP:VAR 3-10PF	91293	5201
C3	295374-001		CAP:VAR 3-10PF	91293	5201
C4	295374-001		CAP:VAR 3-10PF	91293	5201
C5	295374-001		CAP:VAR 3-10PF	91293	5201
FL1	293608-001	1	FILTER CONNECTOR	72982	1201-066
J1	299233-001	2	CONNECTOR:ST BULKHEAD	98291	51-045-0000
J2	299233-001		CONNECTOR:ST BULKHEAD	98291	51-045-0000
A9A1	298965-001	1	PWB ASSY, 330/331 MHZ FILT/AMPL INPUT	56872	298965-001
C1	293746-001	2	CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C2	299243-001	4	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C3	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C4	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C5	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C6	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
E2	293306-001	1	TERMINAL:DISCONNECT	71279	1019-2-901
L1	299237-012	2	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L2	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
Q1	299239-001	1	TRANSISTOR:NPN SI	04713	2N5179
R1	299701-822	2	RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R2	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R3	299701-102	1	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R4	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
A9A2	298966-001	1	PWB ASSY, 330/331 MHZ FILT/AMPL OUTPUT	56872	298966-001
C1	299243-001	7	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C2	293746-001	2	CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C3	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C4	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C5	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C6	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A9A2C7	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C8	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C9	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C10	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
E2	293306-001	2	TERMINAL:SOLDER	71279	1019-2-901
E3	293306-001		TERMINAL, SOLDER	71279	1019-2-901
L1	299237-012	4	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L2	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L3	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L4	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
Q1	299239-001	2	TRANSISTOR:NPN SI	04713	2N5179
Q2	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R1	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R2	299701-822	4	RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R3	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R4	299701-152	1	RESISTOR:FXD CAR 1.5K -+5% 1/4W	01121	RC07GF152J
R5	299701-822		RESISTOR:FXD CAR 8.2K -0+5% 1/4W	01121	RC07GF822J
R6	299701-822		RESISTOR:FXD CAR 8.2K -+5% 1/4W	01121	RC07GF822J
R7	299701-102	1	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
A10	298937-001		HIGH FREQUENCY SECTION ASSEMBLY	56872	298937-001
FL1	293608-001	9	FILTER CONNECTOR	72982	1201-066
FL2	293608-001		FILTER CONNECTOR	72982	1201-066
FL3	293608-001		FILTER CONNECTOR	72982	1201-066
FL4	293608-001		FILTER CONNECTOR	72982	1201-066
FL5	293608-001		FILTER CONNECTOR	72982	1201-066
FL7	293608-001		FILTER CONNECTOR	72982	1201-066
FL8	293608-001		FILTER CONNECTOR	72982	1201-066
FL9	293608-001		FILTER CONNECTOR	72982	1201-066
FL10	293608-001		FILTER CONNECTOR	72982	1201-066
J1	299233-001	1	CONNECTOR:ST BULKHEAD	98291	51-045-0000
J2	299234-001	5	CONNECTOR:RT ANGLE BULKHEAD	98291	51-047-0000
J3	299234-001		CONNECTOR:RT ANGLE BULKHEAD	98291	51-047-0000
J4	299234-001		CONNECTOR:RT ANGLE BULKHEAD	98291	51-047-0000
J5	299234-001		CONNECTOR:RT ANGLE BULKHEAD	98291	51-047-0000
J6	299234-001		CONNECTOR:RT ANGLE BULKHEAD	98291	51-047-0000
A10A1	298995-001		PWB ASSY, 337 MHZ OSC/ISOL	56872	298995-001
C1	293746-001	7	CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C2	299241-360	1	CAP:FXD DIP MICA 36PF -+5% 300WVDC	72136	DM5-360J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A10A1C27	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C28	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C29	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C30	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C31	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C32	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C33	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C34	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C36	299241-100	2	CAP:FXD DIP MICA 10PF –+0.5PF 300WVDC 10	72136	DM5-100J
C37	299241-080		CAP:FXD DIP MICA 8PF –+0.5PF 300WVDC	72136	DM5-080D
C38	299241-050		CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	DM5-050D
C39	299241-050		CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	DM5-050D
C40	299241-080		CAP:FXD DIP MICA 8PF –+0.5PF 300WVDC	72136	DM5-080D
C41	299241-100		CAP:FXD DIP MICA 10PF –+0.5PF 300WVDC	72136	DM5-100J
C42	299241-080		CAP:FXD DIP MICA 8PF –+0.5PF 300WVDC	72136	DM5-080D
E1	293310-001	3	TERMINAL SOLDER	71279	1597-2-01
E3	293310-001		TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
L1	299237-012	8	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L2	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L3	299257-001	1	INDUCTOR:FXD .133UH	56872	299257-001
L4	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L6	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L7	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L8	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L9	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L10	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L23	299237-008	1	INDUCTOR:FXD MOLDED .33UH	99800	1025-08
Q1	299239-001	8	TRANSISTOR:NPN SI	04713	2N5179
Q2	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q3	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q4	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q5	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q6	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q7	299239-001		TRANSISTOR:NPN SI	04713	2N5179
Q8	299239-001		TRANSISTOR:NPN SI	04713	2N5179
R1	299701-622	1	RESISTOR:FXD CAR 6.2K –+5% 1/4W	01121	RC07GF622J
R2	299701-362	1	RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R3	299701-471	6	RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R4	299701-472	12	RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R5	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R6	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R7	299701-103	1	RESISTOR:FXD CAR 10K –+5% 1/4W	01121	RC07GF103J
R8	299701-821	1	RESISTOR:FXD CAR 820 OHM –+5% 1/4W	01121	RC07GF821J
R9	299701-180	2	RESISTOR:FXD CAR 18 OHM –+5% 1/4W	01121	RC07GF180J
R10	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R11	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R12	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R14	299701-470	6	RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R15	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R16	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R17	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R18	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R20	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R21	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R22	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R23	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R24	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R26	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R27	299701-470		RESISTOR:FXD CAR 47 OHM –+5% 1/4W	01121	RC07GF470J
R28	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R29	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R30	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A10A1R31	299701-180		RESISTOR:FXD CAR 18 OHM –+5% 1/4W	01121	RC07GF180J
R32	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R33	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R34	299701-152	1	RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
Y1	298315-001	1	CRYSTAL:112.333 MHZ	56872	298315-001
A10A2	298996-001	1	PWB ASSY, 337 MHZ ISOLATOR	56872	298996-001
C1	299243-001	12	CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C2	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C3	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C4	299241-050	4	CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	CM5-050D
C5	293910-001	4	CAP:VAR TRMR CER 2-8PF	72982	538-037-A-2-8
C6	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C7	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C8	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C9	293910-001		CAP:VAR TRMR CER 2-8PF	72982	538-037-A-2-8
C10	299241-050		CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	DM5-050D
C11	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C12	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C13	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C14	299241-080	2	CAP:FXD DIP MICA 8PF –+0.5PF 300WVDC	72136	CM5-080D
C15	293910-001		CAP:VAR TRMR CER 2-8PF	72982	538-037-A-2-8
C16	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C17	299243-001		CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C18	299243-001	1	CAP:FXD CER DISC .001UF –+20% 1000WVDC	56289	CK60AW102M
C19	299241-120	1	CAP:FXD DIP MICA 12PF –+5% 300WVDC	72136	DM5-170J
C20	293910-001		CAP:VAR TRMR CER 2-8PF	72982	538-037-A-2-8
C21	299240-001		CAP:FXD DIP TA 6.8UF –+20% 35WVDC	31433	T368B685M035AS
C22	299245-002	1	CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-03M
C23	299241-080		CAP:FXD DIP MICA 8PF –+0.5PF 300WVDC	72136	DM5-080D
C24	299241-050		CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	DM5-050D
C25	299241-050		CAP:FXD DIP MICA 5PF –+0.5PF 300WVDC	72136	DM5-050D
E1	293310-001	3	TERMINAL SOLDER	71279	1597-2-01
E2	293310-001		TERMINAL SOLDER	71279	1597-2-01
E5	293310-001		TERMINAL SOLDER	71279	1597-2-01
L1	299237-012	5	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L2	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L3	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L4	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L5	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A10A3	298901-001	1	PWB ASSY, 30-40 MHZ BPF/AMPLIFIER	56872	298901-001
C1	299250-301	4	CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FD301J03
C2	299250-301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FD301J03
C3	299241-120	2	CAP:FXD DIP MICA 12PF -+0.5PF 300WVDC	72136	DM5-120J
C4	299243-001	3	CAP:FXD DIP MICA .001UF -+20% 1000WVDC	56289	CK60AW102M
C5	299250-151	2	CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03
C6	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C7	299250-151		CAP:FXD DIP MICA 150PF -+5% 500WVDC	14655	CM04FD151J03
C8	299241-120		CAP:FXD DIP MICA 12PF -+0.5PF 300WVDC	72136	DM5-120J
C9	299250-301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
C10	299250-301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
C11	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
E1	293310-001	2	TERMINAL SOLDER	71279	1597-2-01
E4	293310-001		TERMINAL SOLDER	71279	1597-2-01
L1	231105-001	4	INDUCTOR:VAR .133UH	56872	231105-001
L2	231105-005	2	INDUCTOR:VAR 2UH	56872	231105-005
L3	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L4	231105-005		INDUCTOR:VAR 2UH	56872	231105-005
L5	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L6	231105-001		INDUCTOR:VAR .133UH	56872	231105-001
L7	299237-048	1	INDUCTOR:FXD MOLDED 15UH	99800	1025-048
Q1	294172-001	1	TRANSISTOR:NPN SI	04713	MPS918
R1	299701-161	3	RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
R2	299701-472	1	RESISTOR:FXD CAR 4.7K -+5% 1/4W	01121	RC07GF472J
R3	299701-102	1	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R4	299701-161		RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
R5	299701-161		RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
A10A4	298902-001		PWB ASSY, 330.5 MHZ POWER AMPLIFIER	56872	298902-001
C1	299243-001	7	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C3	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C4	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C5	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C6	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C7	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C8	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C9	293746-001	3	CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C10	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C11	299241-100	2	CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C12	299241-100		CAP:FXD DIP MICA 10PF -+0.5PF 300WVDC	72136	DM5-100J
C13	299241-360	2	CAP:FXD DIP MICA 36PF -+5% 300WVDC	72136	DM5-360J
C14	293746-001		CAP:VAR TRMR CER 2-8PF	72982	538-011-A-2-8
C15	299241-360		CAP:FXD DIP MICA 36PF -+5% 300WVDC	72136	DM5-360J
C16	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
E1	293310-001	1	TERMINAL SOLDER	71279	1597-2-01
E2	293306-001	2	TERMINAL, SOLDER	71279	1019-2-901
E3	293306-001		TERMINAL, SOLDER	71279	1019-2-901
L3	299237-012	2	INDUCTOR:FXD MOLDED .47UH	99800	1025-012
L4	298899-002	3	INDUCTOR:FXD .04UH	56872	298899-002
L5	298899-002		INDUCTOR:FXD .04UH	56872	298899-002
L6	298899-002		INDUCTOR:FXD .04UH	56872	298899-002
L7	299237-012		INDUCTOR:FXD MOLDED .47UH	99800	1025-012
M1	231104-003	1	MIXER	15542	SRA-1WH
Q1	299239-001	1	TRANSISTOR:NPN SI	04713	2N5179
Q2	294147-001	2	TRANSISTOR:NPN SI	04713	2N3866
Q3	294147-001		TRANSISTOR:NPN SI	04713	2N3866
R1	299701-180	1	RESISTOR:FXD CAR 18 OHM -+5% 1/4W	01121	RC07GF180J
R2	299701-622	2	RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R3	299701-622		RESISTOR:FXD CAR 6.2K -+5% 1/4W	01121	RC07GF622J
R4	299701-681	1	RESISTOR:FXD CAR 680 OHM -+5% 1/4W	01121	RC07GF681J
R5	299701-301	2	RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R6	299701-102	2	RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R7	299701-201	1	RESISTOR:FXD CAR 200 OHM -+5% 1/4W	01121	RC07GF201J

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A10A4R8	299701-102		RESISTOR:FXD CAR 1K -+5% 1/4W	01121	RC07GF102J
R9	299701-301		RESISTOR:FXD CAR 300 OHM -+5% 1/4W	01121	RC07GF301J
R10	299701-161	3	RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
R15	299701-470	1	RESISTOR:FXD CAR 47 OHM -+5% 1/4W	01121	RC07GF470J
R16	299701-161		RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
R17	299701-161		RESISTOR:FXD CAR 160 OHM -+5% 1/4W	01121	RC07GF161J
A10A5	298900-001	1	PWB ASSY, 1-5 MHZ COMB GENERATOR	56872	298900-001
C1	299243-001	10	CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C2	299240-002	1	CAP:FXD DIP TA 22UF -+20% -5WVDC	31433	T368B226M015AS
C3	299240-001	1	CAP:FXD DIP TA 6.8UF -+20% 35WVDC	31433	T368B685M035AS
C4	299245-001	1	CAP:FXD CER .1UF -+20% 50WVDC	72982	8121-M058-W5R0-104M
C5	299245-002	8	CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C6	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C7	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C8	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C9	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C10	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C11	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C12	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C13	299243-001		CAP:FXD CER DISC .001UF -+20% 1000WVDC	56289	CK60AW102M
C14	299243-001		CAP:FXD CER DISC .001UF ±20% 1000WVDC	56289	CK60AW102M
C17	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C18	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C19	299250-132	2	CAP:FXD DIP MICA 1300PF -+5% 500WVDC	14655	CM06FD132J03
C20	299250-432	1	CAP:FXD DIP MICA 4300PF -+5% 500WVDC	14655	CM06FD432J03
C21	299250-132		CAP:FXD DIP MICA 1300PF -+5% 500WVDC	14655	CM06FD132J03
C22	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C23	299250-471	2	CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C24	299250-162	1	CAP:FXD DIP MICA 1600PF -+5% 500WVDC	14655	CM06FD162J03
C25	299250-471		CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C26	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C27	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-621-103M
C28	299250-301	4	CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03
C29	299250-102	2	CAP:FXD DIP MICA 1000PF -+5% 500WVDC	14655	CM06FD102J03
C30	299250-301		CAP:FXD DIP MICA 300PF -+5% 300WVDC	14655	CM04FC301J03

Reference Designation	AILTECH Part Number	Qty	Description	Mfr. Code	Mfr Part Number
A10A5L13	299237-028		INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L14	299237-028		INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L15	299237-028		INDUCTOR:FXD MOLDED 2.2UH	99800	1025-028
L17	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
Q1	294172-001	1	TRANSISTOR:NPN SI	04713	MPS918
Q2	294153-001	4	TRANSISTOR:PNP SI	04713	2N4126
Q3	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q4	294153-001		TRANSISTOR:PNP SI	04713	2N4126
Q5	294173-001	3	TRANSISTOR:FET	98571	U1897E
Q6	294173-001		TRANSISTOR:FET	98571	U1897E
Q7	294173-001		TRANSISTOR:FET	98571	U1897E
Q8	294153-001		TRANSISTOR:PNP SI	04713	2N4126
R1	299701-362	1	RESISTOR:FXD CAR 3.6K –+5% 1/4W	01121	RC07GF362J
R2	299701-242	1	RESISTOR:FXD CAR 2.4K –+5% 1/4W	01121	RC07GF242J
R3	299701-471	2	RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R4	299701-301	3	RESISTOR:FXD CAR 300 OHM –+5% 1/4W	01121	RC07GF301J
R5	299701-472	4	RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R6	299701-471		RESISTOR:FXD CAR 470 OHM –+5% 1/4W	01121	RC07GF471J
R7	299701-201	3	RESISTOR:FXD CAR 200 OHM –+5% 1/4W	01121	RC07GF201J
R8	299701-201		RESISTOR:FXD CAR 200 OHM –+5% 1/4W	01121	RC07GF201J
R9	299701-201		RESISTOR:FXD CAR 200 OHM –+5% 1/4W	01121	RC07GF201J
R10	299701-680	3	RESISTOR:FXD CAR 68 OHM –+5% 1/4W	01121	RC07GF680J
R11	299701-680		RESISTOR:FXD CAR 68 OHM –+5% 1/4W	01121	RC07GF680J
R12	299701-680		RESISTOR:FXD CAR 68 OHM –+5% 1/4W	01121	RC07GF680J
R13	299701-102	4	RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R14	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R15	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R16	299701-203	3	RESISTOR:FXD CAR 20K –+5% 1/4W	01121	RC07GF203J
R17	299701-203		RESISTOR:FXD CAR 20K –+5% 1/4W	01121	RC07GF203J
R18	299701-203		RESISTOR:FXD CAR 20K –+5% 1/4W	01121	RC07GF203J
R19	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R20	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R21	299701-472		RESISTOR:FXD CAR 4.7K –+5% 1/4W	01121	RC07GF472J
R22	299701-180	1	RESISTOR:FXD CAR 18 OHM –+5% 1/4W	01121	RC07GF180J
R23	299701-301		RESISTOR:FXD CAR 300 OHM –+5% 1/4W	01121	RC07GF301J
R24	299701-301		RESISTOR:FXD CAR 300 OHM –+5% 1/4W	01121	RC07GF301J
R25	299701-152	2	RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
R26	299701-102		RESISTOR:FXD CAR 1K –+5% 1/4W	01121	RC07GF102J
R28	299701-152		RESISTOR:FXD CAR 1.5K –+5% 1/4W	01121	RC07GF152J
U1	293622-001	1	IC:TTL BINARY COUNTER	72314	HM7603-5
U2	293350-001	3	IC:TTL DUAL J-K FF	01295	SN74S113N
U3	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U4	293633-001	1	IC:TTL DUAL J-K FF	01295	SN74S112N
U5	293350-001		IC:TTL DUAL J-K FF	01295	SN74S113N
U6	293634-001	1	IC:TTL QUAD 2 INPUT NOR GATES	01295	SN74S08N
	294567-001	2	SOCKET, 16 PIN	01295	C931610
	294573-001	4	SOCKET, 14 PIN	01295	C931410
A10A6	298903-001	1	29 MHZ FILTER CONVERTER	56872	298903-001
C1	299250-391	2	CAP:FXD DIP MICA 390PF –+5% 100WVDC	14655	CM04FA391J03
C2	299241-820	2	CAP:FXD DIP MICA 82PF –+5% 300WVDC	72136	DM5-820J
C3	299241-820		CAP:FXD DIP MICA 82PF –+5% 300WVDC	72136	DM5-820J
C4	299250-391		CAP:FXD DIP MICA 390PF –+5% 100WVDC	14655	CM04FA391J03
C6	299245-002	5	CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C7	299245-002		CAP:FXD CER .01UF –+20% 50WVDC	72982	8121-M058-651-103M
C8	299241-680	14	CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C10	299241-030	4	CAP:FXD DIP MICA 3PF –+0.5PF 300WVDC	72136	DM5-030D
C11	299241-680		CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C12	299241-680		CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C13	299241-680		CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C14	299241-680		CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C15	299241-680		CAP:FXD DIP MICA 68PF –+5% 300WVDC	72136	DM5-680J
C16	299241-680		CAP:FXD DIP MICA 67PF –+5% 300WVDC	72136	DM5-680J
C17	299241-020	6	CAP:FXD DIP MICA 2PF –+0.5PF 300WVDC	72136	DM5-020D
C18	299241-020		CAP:FXD DIP MICA 2PF –+0.5PF 300WVDC	72136	DM5-020D

Reference Designation	AILTECH Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10A6 C19	299241-020		CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C20	299241-030		CAP:FXD DIP MICA 3PF -+0.5PF 300WVDC	72136	DM5-030D
C21	299241-750	2	CAP:FXD DIP MICA 75PF -+5% 300WVDC	72136	DM5-750J
C22	299250-471	3	CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C24	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C25	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C26	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C28	299241-030		CAP:FXD DIP MICA 3PF -+0.5PF 300WVDC	72136	DM5-030D
C29	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C30	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C31	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C32	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C33	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C34	299241-680		CAP:FXD DIP MICA 68PF -+5% 300WVDC	72136	DM5-680J
C36	299241-020		CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C37	299241-020		CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C38	299241-020		CAP:FXD DIP MICA 2PF -+0.5PF 300WVDC	72136	DM5-020D
C39	299241-030		CAP:FXD DIP MICA 3PF -+0.5PF 300WVDC	72136	DM5-030D
C40	288241-750		CAP:FXD DIP MICA 75PF -+5% 300WVDC	72136	DM5-750J
C41	299250-471		CAP:FXD DIP MICA 470PF -+5% 500WVDC	14655	CM06FD471J03
C42	299245-002		CAP:FXD CER .01UF -+20% 50WVDC	72982	8121-M058-651-103M
C43	299240-001	1	CAP:FXD DIP TA 6.8PF -+20% 35WVDC	31433	T368B685M035AS
C44	299250-471		CAP:FXD DIP MICA 470PF 5% 500WVDC	14655	CM06FD471J03
E1	293310-001		TERMINAL SOLDER	71279	1597-2-01
J10	299235-001	2	CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
J11	299235-001		CONNECTOR:RT ANGLE PC BD	98291	51-353-0000
L1	299237-044	1	INDUCTOR:FXD MOLDED 10UH	99800	1025-044
L2	231105-003	18	INDUCTOR:VAR .44UH	56872	231105-003
L3	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L5	299237-048	7	INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L6	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L7	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L8	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L9	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L10	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L11	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L12	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L13	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L14	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L15	299237-048		INDUCTOR:FXD MOLDED 15UH	99800	1025-048
L17	231105-003		INDUCTOR:VAR .44UH	56872	231105-003
L18	231105-003		INDUCTOR:VAR .44UH	56872	231105-003